

CLASSIFICATION AND INTERPRETATION OF GARRY OAK
(*Quercus garryana*) PLANT COMMUNITIES AND ECOSYSTEMS IN
SOUTHWESTERN BRITISH COLUMBIA

by

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ABSTRACT

I sampled the plant communities associated with Garry oak (*Quercus garryana*) in British Columbia in order to develop a classification for use in resource management. Garry oak ecosystems have been designated as critically imperiled in British Columbia. My methods employed some quantitative aspects, but were largely subjective in order to assemble a numerically-adequate data base, apply a landscape approach and include a wide geographic coverage. Although some facets of my study were influenced by European phytosociology, both methodological affinities and the results of objective comparisons place the classification in a scientific context with other studies from the Pacific Northwest oak woodlands. Forty-three (43) plant communities were identified and are described in detail. They consist of 27 communities in a category named for native plant species and 17 communities named for introduced species, organized in two categories of previous disturbance. Similar plant communities are recognized from the literature on other oak woodlands in the Pacific Northwest.

The ecosystem relations of the plant communities are depicted on a subjective basis from the collected field data, supplemented with objective results at a broad level. Ecological hypotheses are suggested, along with management interpretations for each of the plant communities. Preservation and active management are emphasized in a management strategy presented for the Garry oak habitat as a whole.

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CHAPTER 1: TERMS OF REFERENCE

1.0 INTRODUCTION

This thesis presents a classification of Garry oak (*Quercus garryana*) communities, based on a three-year reconnaissance ecological survey within the Vancouver Island and Gulf Islands portions of the range of Garry oak in British Columbia (Figure 1). The U.S. range of Garry oak was also integrated (Figure 2).

Plant species data from over 300 Garry oak plots in all but the most disturbed communities were used to form the classification. An overview of the U.S. part of the range was obtained using literature and field work, including data from 23 plots. All plots were selected to contain oaks, therefore I did not describe the meadow portion of the landscape in which oaks are peripheral, but visually prominent. Environmental site information was collected for descriptive purposes. Subjective sampling methods were used, which have their roots in European and western North American traditions. This is not statistical work and cannot be extrapolated inferentially to the total population. However, I do extend my results to the Garry oak habitat on a subjective basis. Each plot description provides a "snapshot in time", founded on a single site visit.

Underlying the thesis work was the urgency for action on the Garry oak ecosystems. Their endangered status sharpened the need for a classification as a basic step in better understanding and accomodating these ecosystems. Management strategies and interpretations are also developed in this thesis to help in efforts to maintain the ecological integrity of the Garry oak communities.

This chapter gives an overview of the terms of reference for the thesis. I left most citations for Chapter 2, which summarizes the ecological information on Garry oak ecosystems prior to my project. Methods are described and discussed in Chapter 3. Results are in Chapters 4, 5, and 6; the management strategy in Chapter 7 and a summary in Chapter 8. Chapters 5 and 6 provide a "look-up" description, interpretation and discussion by plant community.

1.1 THE NEED FOR THE STUDY

Garry oak communities are at risk in British Columbia (British Columbia Ministry of Environment, Lands and Parks, 1993). They have declined dramatically, and most of the remaining communities have been strongly modified. It is probable that these ecosystems will be completely lost if determined conservation measures are not undertaken. Such loss would seriously threaten the biodiversity heritage of British Columbia. Ceska (1992) estimated that approximately 140 of British Columbia's plant species (6% of the total vascular flora) are found only in these habitats (British Columbia Conservation Data Centre, 1995). Garry oak communities also sustain an impressively large proportion of the rare and potentially vulnerable plant taxa (red- and blue-lists) (op.cit.) and the taxa which may become vulnerable in the near future (yellow-list). About 75 red and blue-listed plant taxa (approximately 12.5 % of the total) and about 50 yellow-listed taxa (approximately 20 % of the total) occur in Garry oak communities (op.cit.).

The threats to Garry oak ecosystems accentuate the need for basic studies that can contribute to preservation and management. Garry oak ecosystems have not received a great deal of focus in the past, but there seems to be a growing awareness and deepening concern, which should support both scientific studies and public action. The full sense of value for the Garry oak ecosystems will probably be realized in the future. Studies now which contribute to their preservation and management are therefore an investment in our future.

There are serious management problems that should be confronted if the remaining ecosystems are to be conserved. Solutions to these problems must be based, in part, on information from research studies. Though Roemer (1972) dealt with the Garry oak ecosystems substantially, research information remains limited. More information is required for understanding the dynamics of the Garry oak landscape. The scope and accuracy of ecological evaluations and recommendations should increase with knowledge extrapolated from the U.S. part of Garry oak's range. A classification of the British Columbia stands based on more intensive sampling will help facilitate judicious application of this knowledge. Sampling programs in British

Columbia have been preoccupied with "undisturbed climax conditions". However, many Garry oak communities are dominated by adventive species, and a comprehensive management approach should be based on understanding them. The fact that my classification focused equally on these communities is one difference from most previous classification work.

There are many management concerns associated with Garry oak communities. My study has been guided by the need for management criteria dealing with:

- the floristic composition of the Garry oak ecosystems
- which communities should be preserved if undisturbed stands are not available
- the adequacy of oak regeneration
- factors that may be limiting oak regeneration, such as the cover of annual grasses
- the possible role of prescribed burning
- the susceptibility of different sites to encroachment by Douglas-fir (*Pseudotsuga menziesii*), native shrubs or broom (*Cytisus scoparius*)
- maintaining biodiversity in the Garry oak communities

1.2 KEY RESEARCH QUESTIONS

The following key research questions were identified to address the management concerns and other needs:

What is the array of plant communities in the Garry oak stands of British Columbia?

What classification framework can be developed for these plant communities ?

What can be suggested about how these plant communities are related to each other, to disturbance, and to major site features ?

What management interpretations are possible from the research information, and what strategy can envelop the interpretations ?

1.3 OBJECTIVES OF THE RESEARCH

The key research questions formed the basis for three objectives:

To gather and interpret information available on the vegetation and ecology of Garry oak ecosystems.

To sample and classify the array of current Garry oak communities in British Columbia at a reconnaissance level.

To interpret management options and implications, including strategies for maintenance and preservation of ecosystem integrity and biodiversity.

The objectives seek to provide information essential to the management and conservation of Garry oak ecosystems, then interpret this information for management and present an overall strategy. A plant community classification provides a framework within which knowledge of ecosystem function and dynamics can be organized. It communicates elements of the Garry oak landscape to managers, scientists and naturalists, and provides a common language which allows knowledge-sharing. A classification establishes a reference point for comparing the results of treatments and suggests hypotheses to investigate. Classification is fundamental to the completion of other needed pursuits, such as inventory and mapping.

CHAPTER 2: BACKGROUND INFORMATION

2.0 INTRODUCTION

This chapter summarizes the literature which provided a foundation for the research. The first purpose is to set the historical, ecological and social context for the study. The second purpose is to identify and discuss both the similarities and differences of the British Columbia communities compared with others.

2.1 DISTRIBUTION AND GENERAL CHARACTERISTICS OF GARRY OAK COMMUNITIES

The distribution of Garry oak, British Columbia's only native oak, is shown in Figures 1 and 2. The oak landscape pattern in British Columbia is a mosaic of separated stands, a characteristic shared with Washington, which Taylor and Boss (1975) called "scattered relics". In contrast, Garry oak forms a continuous part of landscapes further south, and extensive portions of Oregon and California are occupied by *Q. garryana* (Figure 2) (Bolsinger, 1988; Riegel et al., 1992). *Q. garryana* is especially abundant in the Willamette Valley of Oregon, which is also near the centre of its distribution.

The British Columbia stands have been described in a variety of ways (Roemer, 1972; Regional District of Comox-Strathcona, 1975; McMinn et al., 1976; Valentine et al., 1978; Pojar and Meidinger, 1991). At the stand level, "oak parkland" seems to be an appropriate label, consistent with world level terminology (Daubenmire, 1968). "Meadows" suitably describes the openings in spring. The mosaic of "savanna" and "woodlands" recognized in the U.S. part of the range (Fonda and Bernardi, 1973; Franklin and Dyrness, 1973; Griffin, 1977; Sugihara et al., 1987; Whitney, 1989) actually also applies to British Columbia at the broader, landscape level. Interspersion with grassland and coniferous forest is a further characteristic of the *Q. garryana* landscape. Association with bedrock outcrops is one landscape feature frequently noted for Garry oak stands in British Columbia (Roemer, 1972; Ceska, 1982; van Vliet et al., 1987).

2.2 VEGETATION HISTORY

The genus *Quercus* has a long history in the Pacific Northwest. This history differs considerably from that of Douglas-fir which competes with oak in many habitats. Oaks are part of an ancient flora known as the Madro-Tertiary, whereas Douglas-fir is placed in the more northerly Arcto-Tertiary flora. Oaks have semi-arid affinities (Raven, 1977) through their links to the Mediterranean (Axelrod, 1975), but also share northern affinities with Europe. Oak fossils have been reported locally in the Upper Cretaceous Nanaimo Group formation (Chaney, 1946; Martin, 1990). Oaks were already present in near-modern form in the Eocene forests of Nevada and Idaho. Understory shrubs such as *Berberis*, *Amelanchier*, *Crataegus*, *Prunus*, and *Rosa* were also present. Oaks, including *Quercus cf. garryana*, were especially abundant in the late Miocene "Thorn Creek" flora from near Boise, Idaho (Axelrod, 1977). *Amelanchier cf. alnifolia* and *Symphoricarpos cf. racemosus* were also present (op. cit.). Their presence suggests a long history of communities similar to those associated with Garry oak today. *Quercus* was present in deciduous forests of what is now British Columbia during the Pliocene or late Miocene (Heusser and King, 1988). The occurrence of oak woodlands during the last interglacial ("Sangamon": Strahler, 1969) has been indicated from marine cores off British Columbia and Oregon (Heusser, 1985).

Mexico is the centre of diversity for North American *Quercus*, with 112 species, and possibly is the nucleus of oak origin and speciation in North America (Daubenmire, 1978). The main populations of oaks probably survived in Mexico during the late Pleistocene, for *Quercus* pollen consistently dominates the 44,000-year record of the Lake Patzcuaro site on the central plateau (McAndrews, 1988). Oak is virtually absent from the glacial pollen record of California (Byrne et al., 1991). However, the possibility of a continuous presence has been suggested for coastal California (R. Hebda, 1993, pers. comm). Following the Pleistocene, the recolonization of California by oak commenced about 13,000 years ago (Byrne et al., 1991). Garry oak reached British Columbia early in the post-glacial warm dry

interval ("Hypsithermal" or "xerothermic"), which also allowed the migration of many other "Californian" species to British Columbia (Hebda, 1983). The arrival of Garry oak in British Columbia has been reported at 11,000 BP (Heusser, 1983), and at 8,000 to 7,000 BP (Hebda, 1995). Detling (1968) attributed the extension of the Madro-Tertiary flora, including species such as *Arctostaphylos columbiana*, to this warm, dry interval. *Q. garryana* has been described as 'thriving' during the Hypsithermal (Heusser, 1960). This past climatic interval likely strengthened floristic similarities within the range of oak woodlands. The pollen record from Saanich Inlet suggests the optimum development of dry Garry oak -- Douglas-fir communities between 7,240 and 4,870 BP (Heusser, 1983). The lateness of these dates after the end of the Hypsithermal may reflect time needed for populations to build. It is possible also that Garry oak is just as well adapted to warm, wet conditions as to warm dry (Hebda, 1995). At 6,000 BP extremely high oak pollen percentages at Saanich Inlet and Rithet's Bog suggest the presence of nearly continuous oak woodlands surrounding both these sites. Therefore, the predominance of oak forest or savannah apparently extended across both a warm dry interval and a warm wet interval for southeastern Vancouver Island (Hebda, 1995).

Subsequently, the Pacific Northwest climate has been cooler and less favourable for Garry oak communities. Today's isolated plant populations are interpreted as remnants of their former continuous distribution under the previous climate (Janszen, 1977, Hebda, 1983). This change in climate may explain the rarity and disjunct distribution of many British Columbia species. The Saanich Inlet and Rithet's Bog records document a decrease in *Q. garryana*, the onset of which has been variously estimated as post 6,000 BP (Hebda, 1995), 4,000 BP (Zirul, 1967) and 2,000 BP (Heusser, 1983). Rapidly drained soils and periodic fire have been suggested as factors which aided oak's ability to persist (Hansen, 1947). It seems survival was also enhanced by insolation exposure (steep south- and west- facing slopes), bedrock exposure and other situations where plant competition was reduced. Reflecting this history, Garry oak communities are adapted to the most severe sites in the Mediterranean climate area of present-day British Columbia. This adaptation

may also restrict them, for the communities are often found only on these sites.

Human cultural influences had a major role in determining the existence and characteristics of Garry oak communities (see 2.5). I consider the aboriginal cultural practices as part of the natural vegetation history of Garry oak communities, but have grouped these influences with post-European contact vegetation change in a later section.

Native ungulates apparently were among the influences controlling the structure and composition of Garry oak ecosystems. Along with coast deer (*Odocoileus hemionus columbianus*), Roosevelt elk (*Cervus elaphus roosevelti*) were present on the Nanaimo Lowlands at the time of European contact (Nuszdorfer et al., 1991). Roemer (1972) suggested that large native ungulates helped to maintain the open character of Garry oak landscapes. Similar landscapes with rock outcrops are important to both these native ungulates (Nyberg and Janz, 1990). Foraging by deer and elk has resulted in broad-scale control of vegetation in other areas, such as Puget Sound (Kruckeberg, 1991), the coastal prairie of California (Heady et al., 1977), and the eastern deciduous forest (Smith, 1976). These examples suggest the possibility of comparable effects on Vancouver Island.

The persistence of Garry oak communities has probably been assisted by the soil attributes which they promoted over their past history (Broersma, 1973; Erickson, 1984a; see 2.4). The characteristic *Ah* horizons likely helped resist conifer and shrub encroachment. Their high organic matter and relatively fine texture leads to high water-holding capacity, promoting high levels of root competition. Soil moisture is retained near the surface, giving advantage to the shallow-rooting herbaceous species of the Garry oak communities. These species are then able to rapidly deplete the moisture supply.

2.3 CLIMATE

The range of Garry oak in British Columbia falls mainly within a distinctive mediterranean climatic zone (Roemer, 1972; Schaefer, 1978; di Castri, 1981) of summer drought and variable precipitation. The majority of oak falls within the <

1.2" (30.5 mm) isohyet for July/August rainfall, and the remainder is within the 2.2" (56 mm) band (Kerr, 1951). Coniferous coast forests generally occupy areas with higher precipitation. A similar pattern occurs on the Saanich Peninsula in Roemer's (1972) map of mean annual precipitation, with most oak present within the lower values: the 27.5" (700 mm) and 30" (762 mm) bands, and most conifers within the > 35" (890 mm) bands. Conversely, abundance of conifers increase and oaks decrease in areas with annual water deficits less than 25 cm (Kerr, 1951). Variability in summer precipitation is a further characteristic. McMinn et al. (1976) emphasized the low annual precipitation (460-690 mm) and high water deficit (356-381 mm) of the core range of Garry oak on the Saanich Peninsula.

2.4 SOILS

The soils of Garry oak communities contrast with those of adjacent coniferous communities. Well-developed *Ah* horizons with mull humus forms distinguish the Garry oak communities. Their classification as Sombric Brunisols (Valentine et al., 1978) is also unique compared to the Douglas-fir landscape, which has Dystric Brunisols, along with moder and weak mor humus forms (Nuszdorfer et al., 1991). Broersma (1973) found that the humic/fulvic acid ratio of organic matter decreased and the degree of podzolization increased across a transect from grass to oak to fir. Sombric Brunisols have higher cation exchange capacities and base saturation than Dystric Brunisols, apparently due to the more intense nutrient cycling, earthworm and microarthropod activity, and reduced leaching on Garry oak sites (op.cit).

2.5 CULTURAL VEGETATION INFLUENCES

Europeans reported landscape burning by aboriginal people throughout the range of Garry oak ecosystems (Johannessen et al., 1971; Norton, 1979; Anderson and Pasquinelli, 1984; Boyd, 1986; Sugihara et al., 1987; Norton et al., n.d.; Turner, 1991). Fire was used as an aboriginal hunting strategy (Moravets, 1932; Martin, 1990; Turner, 1991). Burning helped to maintain open prairies, favouring oak over conifers (Roemer, 1972) and herbaceous vegetation over shrubs (McMinn et al., 1976). Oak

woodlands and open prairies were important in supporting a large number of useable plant species (Norton, 1979). Camas meadows (*Camassia quamash*, *C. leichtlinii*) were the focus of native plant use in the northern range of Garry oak (Suttles, 1951; Turner and Bell, 1971; Norton, 1979; Norton et al., n.d.). At least in some areas camas beds were burned each year (Turner and Bell, 1971). The historic evidence suggests that Garry oak communities were adapted to a frequent fire cycle. Understanding this vegetation therefore requires the consideration of the role of fire. Past cultural burning seems to be the factor which permitted oak occupancy of some deep soil areas, where competitors might otherwise eliminate Garry oak communities.

The post-European contact era has been marked by the detrimental impacts of vegetation change on Garry oak communities. Present vegetation cannot be evaluated without considering these changes. Conifer encroachment has been widespread (Day et al., 1959; Franklin and Dyrness, 1973; Regional District of Comox-Strathcona, 1975; Zinke 1977; Barnhart et al., 1986; Martin, 1990; Keeler-Wolf, 1990; Kruckeberg, 1991; Reed, 1991; G. Dickey, 1992, pers.comm.). This encroachment, of Douglas-fir in the British Columbia range, can be attributed to a number of factors. The lack of landscape burning diminished the competitive advantage of oaks and allowed Douglas-fir to survive. Agricultural development reduced wildfires, exposed bare mineral soil for establishment, and created moister micro-sites for their survival. Domestic grazing also created bare mineral soil, reduced acorn crops on the ground, and minimized plant competition. On the other hand, the 'park-like' oak stands of the Saanich Peninsula may have been relatively stable (Roemer, 1972), in contrast to the otherwise widespread Douglas-fir encroachment.

The loss of certain native species from Garry oak communities has been another major influence on overall vegetation. Many of the rare species are characteristic southern floral elements that have disappeared from most of their British Columbia range in the last century (Ceska, 1982). These include *Castilleja levisecta* (yellow paintbrush) (op. cit.), *Ranunculus californicus* and *Meconella oregana*

(Pojar, 1980b). This southern flora is now limited to refuges such as Trial Island Ecological Reserve.

There has been a rapid spread of introduced species since European settlement all along the Pacific west coast (Cooper, 1860; Jepson, 1925; Robbins et al., 1951; Frenkel, 1970; Holmes, 1990). The majority of species arrived by the late 1800's. Many dominants were originally used for domestic seeding, including orchardgrass (*Dactylis glomerata*) and Kentucky bluegrass (*Poa pratensis*) (Roemer, 1972). Szczawinski and Harrison (1973) recorded a total of 333 introduced taxa in 1966-7 on the Saanich Peninsula. Janszen (1981) listed 143 and 157 alien taxa from Saturna and Mayne Islands, representing about a third of the island totals.

Detrimental effects of domestic livestock grazing have impacted the communities throughout the range of Garry oak. Use by pigs, sheep, goats, cattle and horses converted most plant communities to their present dominance by adventive species (Thilenius, 1964; Roemer, 1972; Janszen, 1977; Smith, 1985; Saenz and Sawyer, 1986; and Sugihara et al., 1987; Holmes, 1990). Unnaturally high deer populations may be limiting plant composition and suppressing oak regeneration, as they do in parts of Washington and California (Kruckeberg, 1991; Martin, 1990; Pavlik et al., 1992).

2.6 OVERVIEW OF PREVIOUS VEGETATION WORK

The following section provides an overview of previous vegetation work, based on the literature reviewed to prepare for my field study. Once my plant communities were determined I imported much of the detail into the discussion of each in Chapters 5 and 6. The full review of the information prior to my field study is found in Appendix 1.

There is a wide variety of plant communities in which Garry oak is an important component. These communities vary from the 'meadow-like' *Quercus-Geranium* (Roemer, 1972) of the Saanich Peninsula, to the *Pinus ponderosa-Quercus garryana/Purshia tridentata/Festuca idahoensis* (Williams, 1978) of the Mt. Hood area

of Oregon and types including *Pinus sabiniana*, *P. lambertiana*, and *Cercocarpus betuloides* in northern California (Keeler-Wolf, 1990). Despite this diversity there are a number of unifying species across the range, although ecological compensation may change the nature of their site relationships. Foremost among these species are the trees, Douglas-fir (*Pseudotsuga menziesii*) and Arbutus (*Arbutus menziesii*). Next is a group of shrubs including *Symphoricarpos albus*, *Holodiscus discolor* and *Amelanchier alnifolia*. Native grasses with a wide distribution include *Elymus glaucus*, *Danthonia californica*, *Festuca idahoensis* and *Bromus carinatus*. A number of adventive grasses (*Cynosurus echinatus*, *Arrhenatherum elatius* and *Dactylis glomerata*) have become naturalized throughout the range.

Despite these broad similarities, there are also differences among the communities. Nemoral forbs, most of which are bulb-forming, seem to characterize the British Columbia Garry oak communities. Pojar (1980b) described the abundance of *Camassia leichtlinii*, *C. quamash*, *Erythronium oregonum*, *Brodiaea coronaria* and *Dodecatheon hendersonii* from some localities. This may reflect more favourable spring growth conditions compared to the U.S. stands, as well as differences in floristic history (e.g. Detling, 1968). Disturbance contrasts seem to be a further factor. The widespread dominance of *Rhus diversiloba* in Oregon, California and parts of Washington is a distinguishing feature. In addition to the paucity of poison oak, bottomland sites also diverge, with the absence of *Fraxinus latifolius* (Oregon white ash) and woody vines (lianas) such as *Marah oregonus* (wild cucumber) from the British Columbia oak landscape.

The following discussion deals with British Columbia Garry oak communities and communities from the U.S. range with a degree of similarity to them. Several Saanich Peninsula communities identified by Roemer (1972) appear to be unique within oak woodlands: the *Quercus-Geranium*, the *Quercus-Erythronium* and the *Quercus-Erythronium-Campanula*. However, Franklin and Dyrness (1973) described communities of the Puget Sound prairie as being similar to these. The Vancouver Island communities share the greatest similarity with two non-oak areas: the Oregon

"balds" (Aldrich, 1972) and the coastal prairie of California (Heady et al., 1977). These types feature a rich forb cover and native grasses.

Arbutus-Pseudotsuga communities in which oak is of minor importance, and *Quercus garryana-Rhacomitrium*-moss communities have been described for the British Columbia portion of the range by Roemer (1972) and others. Only one comparable description has appeared for the U.S. portion of the range. Oak is associated with grassland in the *Bromus rigidus - Rhacomitrium canescens* community and with *Pseudotsuga menziesii* on Pt. Disney, Waldron Is., Washington (Salstrom, 1989).

The *Quercus/Amelanchier/Symphoricarpos* community, described from the Willamette Valley, Oregon by Thilenius (1964, 1968), is widespread across the geographic range, including British Columbia. Communities noted for *Holodiscus discolor* are also well represented across the geographic range.

Riegel et al. (1992) described *Quercus garryana-Pseudotsuga menziesii/Elymus glaucus* and *Quercus garryana/Bromus carinatus* communities for the southern interior valleys of Oregon. Similar types have also been recorded from throughout the range and the two non-oak areas: the Oregon "balds" (Aldrich, 1972) and the coastal prairie of California (Heady et al., 1977).

Two types characterized by introduced species are widespread. The first is the *Quercus garryana/Rhus diversiloba/Dactylis glomerata* (Smith 1985), although British Columbia stands do not include *Rhus*. *Cynosurus echinatus* is a dominant species in several areas (Smith, 1985), including the British Columbia portion of the range.

2.7 VALUES AND STATUS

Oaks, including Garry oak, were important for their acorns to the aboriginal people further south along the west coast. Oaks were potentially important in the British Columbia range as providers of large quantities of high food-value acorns. However, bulbs from the Garry oak habitat, such as those of Camas were more fundamental for the Vancouver Island people and "places to gather camas" (Penn,

1992b) were important in the local economy.

The European explorers and settlers were attracted to the aesthetic qualities of the oak landscape. Captain George Vancouver called it "as enchantingly beautiful as the most elegantly finished pleasure ground in Europe" (Penn, 1992b). Garry oak landscapes continue to be important for their aesthetics and their contribution both to the sense of place and the regional identity of Victorians (e.g. Penn, 1992a). Martin (1990) felt that oak groves on Hornby Island "should be preserved to serve the whole community's spiritual needs, as well as for themselves and the spirit they embody." The British Columbia Conservation Data Centre (1992) described Garry oak as

... a tree of unique form: a sturdy bole which may curve leisurely, or stretch upward with the grace of a Greek column. The limbs and branches stretch and bend in unexpected contortions, yet manage to create an almost perfect convex outline when viewed against the sky. Backed by the rising or setting sun, this stark silhouette stirs the imagination and humbles the soul.

Garry oak communities also provide the ecological benefits associated with trees in general. Microclimate and air quality enhancement, soil stabilization and vitality, hydrologic control, and the provision of food and shelter for wildlife are among the amenities recognized (British Columbia Heritage Conservation Branch, 1983). A special role could be played by Garry oak communities in adjusting to the impact of future climate change (Hebda, 1991, 1992). This will be salient if scenarios of future climate are correct. The climate of our coast is predicted to become analogous to that of California and Douglas-fir should retreat from its current range (Benton, 1993). The genetic material of the Garry oak communities may provide the means to repopulate the void, because of their ability to tolerate a drier climate (Detling, 1968; Franklin and Dyrness, 1973).

The value to society of the Garry oak landscape is now being reinforced by certain political measures. Victoria City Council (1992) adopted a resolution recognizing the historic and ecological significance of the Garry oak ecosystem. At least one politician, Cubberley (1992) of Saanich Council, referred to the tree as "our

foundation native species." This type of regard has been translated into action with the first tree preservation bylaws.

Garry oak ecosystems have been identified as part of a biodiversity "hot spot" (British Columbia Ministry of Forests, n.d.). This designation reflects their limited extent, provincially significant biodiversity, rare species, and the trend of accelerating habitat loss (Nuszdorfer et al., 1991). The Garry oak flora was described by Pojar (1980b, p.40) as "one of the most phytogeographically interesting in Canada," with species such as *Tritelia howellii*, *Castilleja levisecta*, *Balsamorhiza deltoidea* and 21 others highlighting the importance of this biotic zone. Our position at the northern margin of the Californian flora has evolutionary significance, for it can lead to genetic diversification -- the "spice of life" (Bunnell and Williams, 1980). Climatic fluctuations and catastrophic selection forces lead to specialization and speciation, especially at the margins (Raven, 1977). Consistent with the theory of island biogeography (MacArthur and Wilson, 1967), island margins compound these effects by preventing the exchange of genetic material.

The Victoria area has one of the most notable concentrations of rare vascular plants within the province (Roemer, 1990). For the Garry oak habitat, an estimate of 40 to 50 rare species (Straley et al., 1985) is probably still the correct order of magnitude. Duncan Forest District, with the largest amount of Garry oak habitat, has 132 rare (and potentially vulnerable taxa), the highest number of all provincial forest districts (British Columbia Conservation Data Centre, 1995). Port Alberni District has the second largest amount of Garry oak habitat and 109 rare taxa. These districts are among six districts with over 100 rare taxa, and substantially above the mean number from all provincial forest districts, which is 40.

Conservation concern is growing for species such as Lewis' woodpecker (*Melanerpes lewis*) (Nuszdorfer et al., 1991); Cooper's hawk (*Accipiter cooperii*) (Campbell, 1992, pers. comm.); western bluebird (*Sialia mexicana*); and band-tailed pigeon (*Columba falcatius*) (Kavanaugh, 1992b, pers.comm.), that rely on, or may be lost from this habitat. Lewis' woodpecker is designated on the blue list as a species considered to be vulnerable or sensitive (Munro, 1993). Weber (1980) attributed the

demise of Lewis' woodpecker partly to the destruction of many Garry oak stands during Victoria's urban development. The loss of oaks has meant the loss of nest-holes and acorns upon which it relied. Introduced starlings have usurped those nest holes which would have remained available. Western bluebirds are also dependent on nest holes and were formerly common in Garry oak habitat. Weber proposed placement in a "special concern" category because of their decline. Other blue-listed species of Garry oak habitat include turkey vulture (*Cathartes aura*), western screech-owl (*Otus kennicottii*) and Hutton's vireo (*Vireo huttoni*). Sharp-tailed snake (*Contia tenuis*) is one red-listed (candidate for threatened or endangered designation) faunal species from the Garry oak habitat (Munro, 1993).

A number of the insect species of the Garry oak habitat have recently been given threatened status (Table 1). They represent an inordinate proportion of the provincial total, 12 out of the 50 species of highest concern (B.C. Ministry Environment, Lands and Parks, 1994). All are have either of the following status: S1) provincially rarest or most threatened; or SX?, NX?) possibly provincially or nationally extirpated). Table 1 lists these insect species by their provincial inventory priority.

Table 1 Threatened Insect Species of Garry Oak Habitats

- (1) Large marble butterfly (*Euchloe ausonides ssp.n.*)
- (2) Chalcedon checkerspot butterfly (*Euphydryas chalcedona perdiccas*)
- (9) plant bug, (*Clivenema fusca*)
- (10) plant bug, (*Ceratocapsus downesi*)
- (28) Greenish blue butterfly (*Plebejus saepiolus insulanicus*)
- (30) a moth, *Autographa speciosa*
- (39) a damsel bug, *Omanonabis lovetti*
- (40) a shield bug, *Camirus porosus*
- (43) a tiger beetle, *Omus audouini*
- (44) Barry's hairstreak butterfly (*Mitoura barryi acuminata*)
- (45) Zerene fritillary butterfly (*Speyeria zerene bremneri*)
- (46) Edith's checkerspot butterfly (*Euphydryas editha taylori*).

There are also a number of other butterflies of Garry oak meadows with "concern" status (Guppy, 1993), as follows:

Moss elfin (*Incisalia mossi mossi*): vulnerable in Canada and globally;
 Ringlet (*Coenonympha tullia insulana*): vulnerable in Canada;
 Propertius duskywing (*Erynnis propertius*): vulnerable in Canada;
 Common branded skipper (*Hesperia oregonia*): status unknown.

The concept of "old growth" has been applied to conifer forests and much attention has been directed to preserving recognized characteristics. Garry oak communities would seem to merit similar attention. The value of old-growth forests is gaining increasing recognition in British Columbia (Old Growth Strategy Project, 1992). Very high preservation priority is placed on forest types that are not well-protected and becoming increasingly scarce as a result of development (op. cit.). Garry oak meets these prerequisites, yet has not been recognized like conifers, which are vastly more widespread and well-protected. Garry oak stands share a number of attributes of old growth (op. cit.): venerable age, multiple canopy layers and large size which can be described as "bumbling". Garry oaks are revered by some for their heritage value, a further characteristic recognized by some for old growth (Pojar, 1991). However, for the most part, Garry oaks are excluded by the old-growth definitions (e.g. Old Growth Strategy Project, 1992). Refinements for each biogeoclimatic subzone are to be developed (Pojar, 1991) which may accommodate Garry oak communities.

Garry oak communities have a limited range in British Columbia. They occupy only a portion of the Coastal Douglas-fir (CDF) biogeoclimatic zone, which itself comprises only 0.3 % of the land area of British Columbia. Furthermore, only 1-5 % of the original Garry oak habitat remains (Hebda, 1992). There is a lack of parks or potential roadless wilderness areas which might serve for preservation (Vold, 1992). The Garry oak-brome community has been rated as one of the most endangered in British Columbia (British Columbia Conservation Data Centre, 1992). In 1993 the Garry oak communities were selected for the first "Ecosystems At Risk" brochure by a cooperative group of government and private agencies (British Columbia Ministry of Environment, Lands and Parks, 1993; Erickson, 1993b) and were also the subject

for the first Garry oak meadow colloquium (Hebda and Aitkens, 1993).

Urban development has been the foremost factor in the decimation of Garry oak habitat, and the trend continues. Many major developments threaten the habitat on southern Vancouver Island. The core of the British Columbia range is within the urban development centre of the Capital Regional District. By my generalized estimates, the largest contiguous occurrence was formerly on the southern part of the Saanich Peninsula, where Garry oak was once "very plentiful," and "an outstanding feature of the landscape" (Pemberton, 1925, p.101). This area, in excess of 3000 ha, is now almost completely urban.

The endangered status of Garry oak ecosystems illustrates a history of degradation and attrition. The elimination of the burning practises of aboriginal people resulted in shrub and Douglas-fir encroachment. Adventive weedy grass species and broom (*Cytisus scoparius*) usurped native plant communities, aided by the impacts of domestic grazing. Browsing by deer and introduced eastern cottontail rabbits (*Sylvilagus floridanus*) added to this affront to oak regeneration and ecosystem development.

The cumulative effect of these influences was recognized in forewarnings by Bodsworth (1970), McMinn et al.(1976) and Pojar (1980a). Pojar described the Garry oak flora as the most threatened in British Columbia and stated that the tree itself could be considered a threatened species. Lack of oak regeneration is an additional concern, particularly in urban areas (Pojar, 1980b). Genetic specialization is associated with species on the periphery of their ranges (Raven, 1977) and may turn out to be the "prophet of doom" (Bunnell and Williams, 1980) for Garry oak ecosystems. Burdened with unrelenting pressures, specialization may account for the strong impact of disturbances. Island biogeography has probably magnified the susceptibility of plants. Fewer adaptations were required for the few species of native mammalian fauna, but this in turn may have limited the response of the native plants, leading to declines when faced with additional pressure from introduced fauna.

A newer peril to Garry oak is posed by the spread and serious impact of two

introduced insect pests: the jumping gall-wasp (*Neuroterus saltatorius*) and the oak-leaf phylloxeran (*Phylloxera glabra*). These species have caused severe defoliation, known locally as scorching. Phylloxeran defoliation weakens oaks in the following years and may threaten their survival with persistent attacks. "Scorching" may threaten the ecosystems by restricting the oak's influence, creating instability. The public may perceive a loss of value at a time when it is critical that the value of the ecosystem be recognized. Scorched oaks may be simply cut down as "dead" by individuals who are unaware that the trees are actually still alive. On the other hand, these insect threats have elevated the level of public concern.

Recent history in California suggests that concern for Garry oak in British Columbia will only grow. There is now a fifteen-year history of information sharing, study and conservation measures for oaks and their habitats in that state (eg. Plumb, 1980; Bolsinger, 1988). Engelmann oak (*Quercus engelmannii*) is California's rarest oak (Scott, 1990), and one of "special concern" (Pavlik et al., 1992). Engelmann oak therefore provides a comparison pertinent to *Q. garryana* in British Columbia if qualified with the range differences. All *Quercus engelmannii* is in California, whereas *Q. garryana* in British Columbia is only a small portion of its total population. *Quercus engelmannii* occupies a woodland area of 77,385 acres (31,317 ha) including the large, contiguous Santa Rosa Plateau Preserve of 1255 ha (Scott, 1990). In contrast, the original British Columbia *Q. garryana* stands probably amounted to less than 10,000 ha and its remnants are likely less than 1,000 ha. Garry oak is protected with substantial representation in only two Ecological Reserves, Mt. Maxwell (64.8 ha) and Mt. Tzouhalem (18 ha), plus the scattering of oak in the 253.8-ha Mt. Tuam Ecological Reserve.

CHAPTER 3: METHODOLOGY

3.0 OVERVIEW OF METHODS (see also 3.21)

The general approach for the field study can be identified with two concepts from the literature, "subjective sampling without preconceived (personal) bias" (Mueller-Dombois and Ellenberg, 1974) and "successive approximation" (Poore, 1962). Field and analytic methods were guided in general by standard manuals or texts (Mueller-Dombois and Ellenberg, 1974; Canada Soil Survey Committee, 1978; Walmsley et al., 1980; Luttmerding et al., 1990; Habitat Monitoring Committee, 1990).

I chose a large geographic area - the main range of Garry oak in British Columbia - for study (Figure 1). Potential areas for the ecological survey were identified from ecological studies, soil reports, aerial photographs, and word-of-mouth accounts. Field reconnaissance was initiated in these potential areas, consisting of a series of walking surveys taking observations of species distributions, communities and their apparent ecological relationships. Communities were noted when combinations of visually dominant plant species were repeated across the landscape.

This reconnaissance information was used along with predetermined criteria to select sites which represented the communities and site attributes. Of the site attributes, particular attention was given to ecological moisture regime class (Walmsley et al., 1980) at the selection stage. Sites were sampled as plots, through a description of vegetation, soils, environment and oak characteristics. Descriptions were taken for each in one of two time-interval classes, early-season (early April to mid- May) and later-season (mid- May to early July). These classes were then developed separately in the classification. Some plots were described for both time-interval classes or the descriptions were used twice when it was possible to characterize both an early-season and a later-season community. I have designated the plot standard as the "reconnaissance plot" level because of the relatively low quantity of data and reduced time allocation for completion, compared with ecological "full-plot" work (e.g. completion of all entries in Walmsley et al., 1980).

The vegetation estimates were used to develop the plant community classification. Each plant community was formed through a process of grouping plots in various combinations based on dominant species, comparison, rearrangement, and refinement. Environmental and other information was used for descriptive purposes. This chapter first describes, then discusses the methods used. References for the methodologies are given in the discussion section (3.2).

3.1 DESCRIPTION OF METHODS (see also 3.22)

3.11 Plot Selection

Sites for plots were selected subjectively using the following criteria:

- oak dominance (co-dominance, sub-dominance)
- understory with native or naturalized species.
- species indicating extreme disturbance (e.g. ivy, blackberry) of lesser cover.
- homogeneity
- areal extent: judged to meet minimal area requirements (70-300 m²)
- representativeness of the site (environmental), stand (Garry oak), and understory characteristics
- sampling needs assessment: replication vs. geographic representation

The sampling needs assessment was done on site to reconcile a) the representation of the particular plant community for each geographic locale with b) amassing the replicates required for the community in the whole study.

For the purposes of this study, the concept of plant communities was simply accepted. A plant community is a "volume of relatively uniform vegetation" (Pojar et al., 1991) which repeats across the landscape in a similar combination. The plants in this combination are thought to be dependent on and modify their environment and influence one another (Mueller-Dombois and Ellenberg, 1974). Together with their common habitat and associated organisms, they form an ecosystem (op.cit.). By classifying the early-season and later-season time-intervals separately I am allowing the possibility of one ecosystem having two plant communities at this scale (site-

level).

Potential plots were examined for these characteristics and compared with the surrounding area. Single large plots (Kuchler, 1988) were selected, with dimensions based on the size and distribution of Garry oak and the homogeneity factors. The strategy was to vary plot size and configuration with site conditions and plant community boundaries. Plot shapes and sizes were selected to relate to the canopy of the oaks, environmental site factors, boundaries and homogeneity in the plant community. The larger sizes and square shapes were more typical of full oak stands; the rounded, sometimes smaller plots corresponded more closely to oak-centred plots in the savannah landscape. A summary of plot size and configuration follows.

Table 2 Summary of the Most Frequent Plot Sizes and Shapes

<u>Square/rectangular 112 plots, 44.8 % of applicable total</u>					
<u>20 x 20 m</u>	<u>15 x 15</u>	<u>10 x 20</u>	<u>10 x 15</u>	<u>15 x 20</u>	<u>10 x 10</u>
20 plots	19	14	14	13	10
<u>Squarish but slightly rounded and rounded,</u>					
<u>37 plots, 14.8 % of applicable total</u>					
<u>10 x 15 m</u>		<u>10 x 10</u>			
7 plots		6			
<u>Circular 24 plots, 9.6 % of the applicable total</u>					
<u>15 m diameter</u>					
9 plots					

In addition to the most frequent categories shown above, there were lower numbers of other shapes and sizes of plots amounting to just over 30% of the total.

3.12 Plot Method (see also 3.23)

The plot work was completed at the "reconnaissance plot" level to meet the objective of sampling the wide array of Garry oak communities across the main distribution in British Columbia. Subjective selection of sites assisted in meeting this objective. All field-level designations of communities remained tentative and open to review and change, consistent with Poore's (1962) strategy of "successive

approximation".

Several measures ensured the rapid completion of the plot work and the numerical adequacy of plot samples. Class estimates of canopy cover provided an efficient field measure of vegetation dominance. Diameter measurements furnished a quick index of the general size and age class of the oaks. Investigation of soils was restricted to surface horizons.

Most sites were sampled with a single visit. The time of sampling corresponded in a general way to "peak vegetation development", occurring between April 21 and June 30, with some flexibility for late-season sampling. My sampling objectives had a "desired" level of ten different plots per field-level plant community (Kuchler, 1988) and a "minimum" level of three plots. Certain sites were revisited at intervals through the growing season, to contribute to the seasonal characterization of the plant communities.

3.13 Forms and Vegetation Data (see also 3.24)

Descriptive entries were recorded on reconnaissance plot forms (Appendix 2). Photographs were taken. Vascular plants were listed and their canopy cover -- the "percentage of the ground included in a vertical projection of imaginary polygons drawn about the total natural spread of the foliage" (Daubenmire, 1959) -- estimated by classes (Table 3). Ground layer non-vascular cryptogams were listed when they met the minimum of class 2 cover. Most species identifications were made in the field, using information from previous floras and ecological studies (e.g. Hitchcock et al., 1969; Roemer, 1972; Szczawinski and Harrison, 1973). Unknown species were collected for later identification. Periodically, voucher specimens were taken to be placed in appropriate herbaria. Taxonomy used for species designations followed either Hitchcock et al. (1969) or Taylor and McBride (1977). Final designations were cross-referenced with Douglas et al. (1989, 1990a, 1990b, 1994), which have been accepted as the standard for ecological field work in British Columbia (Meidinger, 1996, pers.comm.). These equivalents are shown in Appendix 11.

Comparison charts for canopy cover estimates (Walmsley et al., 1980) served

for standardization and calibration. An informal chart assisted the estimates by converting the quantity of small plants to quantity of cover. Where necessary, plots were divided visually into tenths for estimating the more difficult covers. A 6-class cover scale was used. The mid-points were coded for use in data summaries in developing the classification.

Table 3 **Cover Class Scale**

	<u>Cover Class</u>	<u>Mid-point</u>
1	0- 1 %	0.5 %
2	2-10 %	6 %
3	11-25 %	18 %
4	26-50 %	38 %
5	51-75 %	63 %
6	76-100 %	88 %

3.14 Environmental Data and Other Information (see also 3.25)

The major categories recorded on the reconnaissance plot sheets (Appendix 1) were: percent slope, aspect, elevation, slope position, surface shape, exposure, surface substrate, ecological moisture regime, surface soil and humus form. Field methods and categories were based on those outlined in Canada Soil Survey Committee (1978) and Walmsley et al.(1980). Ecological moisture regime is a subjectively assessed expression of the moisture environment of a given site relative to other sites. In this assessment an established scale is used to depict conditions ranging from very dry (very xeric) to very wet (hydric), as shown in Table 4. One class, "permesic", was added between mesic and subhygric, and intergrades between the other classes were assigned as appropriate. Because of my emphasis on surface soils, soil survey reports were the main source of information about subsoils. Humus form depiction used the basic taxonomy from Klinka et al. (1981). Diameters of typical oaks and other trees were measured. The hardwood form-classes of Bolsinger (1988) were tested, applied and refined (Erickson, 1993c). This information provided input for the oak form-complexity rating used in the wildlife habitat and aesthetic/recreational interpretations (5.13). Detections of wildlife and wildlife habitat

Table 4 Ecological Moisture Regime Classes²

MOISTURE REGIME	DEFINING CHARACTERISTICS		FIELD RECOGNITION CHARACTERISTICS						SLOPE GRADIENT
	DESCRIPTION	PRIMARY WATER SOURCE	SLOPE POSITION	SOIL PROPERTIES					
				TEXTURE	DRAINAGE	DEPTH TO IMPERMEABLE LAYER	SURFACE HUMUS DEPTH	AVAILABLE WATER STOR. CAP.	
VERY XERIC	Water removed extremely rapidly in relation to supply; soil is moist for a negligible time after ppt	precipitation	ridge crests shedding	very coarse (gravelly-s) abundant coarse fragments	very rapid	very shallow (<0.5m)	very shallow	extremely low	very steep (especially on south aspects)
XERIC	Water removed very rapidly in relation to supply; soil is moist for brief periods following ppt	precipitation			rapid				
SUBXERIC	Water removed rapidly in relation to supply; soil is moist for short periods following ppt	precipitation	upper slopes shedding	coarse to med. coarse (LS-SL) mod. coarse fragments	rapid to well	shallow (cm)	shallow	very low	steep
SUBMESIC	Water removed readily in relation to supply; water available for moderately short periods following ppt	precipitation						low	moderate
MESIC	Water removed somewhat slowly in relation to supply; soil may remain moist for a significant, but sometimes short period of the year. Available soil moisture reflect climatic inputs.	precipitation	mid-slope normal rolling to flat	moderate to fine (L-SIL) few coarse fragments	well to moderately well	moderately deep (1-2 m)	moderately deep	moderate	
SUBHYGRIC	Water removed slowly enough to keep the soil wet for a significant part of the growing season; some temporary seepage and possibly mottling below 20 cm	precipitation and seepage			moderately well to imperfect	deep (>2 m)	deep	high	slight
HYGRIC	Water removed slowly enough to keep the soil wet for most of the growing season; permanent seepage and mottling present, possibly weak gleying	seepage	lower slopes receiving	variable depending on seepage	imperfect to poor	variable depending on seepage		variable depending on seepage	
SUBHYDRIC	Water removed slowly enough to keep the water table at or near the surface for most of the year; gleyed mineral or organic soils; permanent seepage less than 30 cm below the surface	seepage or permanent water table			poor to very poor		very deep		
HYDRIC	Water removed so slowly that the water table is at or above the soil surface all year; gleyed mineral or organic soils	permanent water table	depressions receiving	Variable depending on seepage	very poor	variable depending on seepage		variable depending on seepage	flat

² excerpted from Walmsley et al, 1980.

attributes were recorded as shown in Appendix 1.

3.15 Classification (see also 3.26)

As in the British Plant Communities project (Rodwell, 1991), a taxonomic framework was not adopted from the literature. Instead plant community was used as a simple, generic term, with sub-communities assigned as appropriate. Internal rules for presence and cover requirements were developed and used consistently. The process of classification started in the field, with a visual review of each vegetation set and the subjective organization of each identifiable grouping into a field-level plant community element. Elements with repeated and consistent occurrence were assigned and listed as plant communities. This list was both developed and numbered sequentially. These original numerical designations have been retained for my purposes and to allow an abbreviated reference to the plant communities. I took the names of previously identified vegetation units (see 2.6) into the field as possible communities. The subjective field process formed the basis both for further sampling and for the first computer-assisted groupings for 1993 and was carried on for the 1994 field and office seasons.

The tabular comparison method (Mueller-Dombois and Ellenberg, 1974) provided a general background for the subjective classification work. This method works with a two-way table of species by plots, sorting them through successive plot placements into a completed synthesis table. The process of this tablework allows recognition of important trends in species distribution between the sample stands, isolates groups of species among the among the stands and places those stands with similar species composition side-by-side in the table (op.cit.). The method is thought to reveal ways of solving problems of separating vegetation into units and uncover information not realized during the field work (op.cit.). My tablework suggested the addition of a some new communities and discouraged maintaining several others.

I used both presence and cover in the process, but emphasized cover. My use of the *EXCEL* (Microsoft *EXCEL* 4.0 A) software greatly reduced the tedious and time-consuming aspects of traditional "hand-work" technique. The program allows

movement of columns (plots) and rows (species), copying to separate worksheets, and easy print-formatting for efficient review.

Each potential plant community was assembled and then evaluated with various optional plot compositions. The primary rules were consistency in presence (constancy) and substantial cover of the species defining the type combined with lesser mean values for the species defining other types. Minimum criteria were a mean presence of **0.70** or more (usually 1.0) in the potential community and minimum cover of class 3 cover (11% or more) for each plot therein. The presence value of ≥ 0.70 means that the species would be present on at least seven out of 10 plots in a group. Logical exceptions were allowed and these are shown in the results, particularly the key to the plant communities. I used the lower standard of ≥ 0.67 for those groups with only three plots. Higher minimum cover levels, equal to cover class 4 (26% or more), were used for some shrub types. Many alternate placements were tried, as well as the combination and separation of groupings, in finalizing and defining the plant communities. When there was more than one possible placement of a plot, I placed it in a potential native plant community (named for native or indigenous species), rather than in an introduced plant community (named for introduced or non-native species, later called "first or second order disturbance communities"). Within these categories decisions still had to be made on placement and these are outlined in the order of classification and structure of the key to the plant communities (see 4.11). Plots were grouped into either an early-season classification or a later-season classification, or both. When grouped into both, the sites will have two classified plant communities, for plot descriptions were either used twice or a revisit was made to the site. The time-interval distinction is carried forward into the key to the plant communities (see 4.11).

I assigned the term "plant community" for the basic units and added plant "subcommunity" (Rodwell, 1991) within these where considered necessary on subjective grounds or based on adjusted Motyka comparison values greater than about 1.0 (see 3.152). Subcommunities were delineated for additional plant species different from the named species of the original plant community, which was retained

as the "Typic" subcommunity. I have kept the terms "plant community" and "community" when referring to these units (communities and subcommunities) in general.

In addition to the subjective process described above, two objective tests were used to aid in assessing and calibrating the groupings and supporting the classification through comparison and refinement. These were a "constant cover value" and my adjustment of the Motyka coefficient of similarity (Mueller-Dombois and Ellenberg, 1974). They were not intended to determine the level of classification, but rather to make suggestions for subjective consideration. *TWINSPAN* (Hill, 1979) was reviewed as an objective means of classification and would have been compared in detail with the subjective classification if it met the review criteria.

3.151 Constant Cover Value Index (see 3.261)

The Constant Cover Value Index is a method I developed to review the success of the subjective grouping process in accounting for a major proportion of the total cover of each group. It can be seen as a refinement of the denominator from the Motyka index of similarity (Mueller-Dombois and Ellenberg, 1974) applied to the "within" comparison (rather than the "between" comparison) (see 3.152). For each plant community the cover was totalled for each of the constant species, those with a presence of >0.70 (≥ 0.67 for those with three plots). This numerator was then divided by the total cover for all species in the community to give the index value. In general, the higher the value, the "better" the grouping. Oak and other tree species were not included.

3.152 Adjusted Motyka Coefficient (see 3.262)

The Motyka index of similarity (Mueller-Dombois and Ellenberg, 1974) is an index for stand or community comparisons using cover as the numeric value. I adjusted this index to compare differences and similarities between the plant communities within my classification. This level of differentiation was also compared with the level from selected plant communities pairs within other classifications. The adjusted Motyka coefficient was modified to match my classification criteria and

approximate my cover classes. Shrub, herb, and moss (B,C and D layer) species with a mean presence of ≥ 0.7 (≥ 0.67 for those with three plots) were included. Tree species were not part of the index. The adjusted Motyka coefficient is a ratio between the similarities and the differences of the two communities, which can be expressed as: *2x the sum of the similarities between A and B divided by the sum of the differences between A and B: $2M_w/MA + MB$.*

The adjusted numerator ($2 M_w$) represents similarities between the two community pairs. It is identical to the Motyka numerator except that the species had to be constant, meeting the mean presence requirement above. The lowest cover value of the two becomes part of the numerator when species are shared by both communities. In my method, species cover differences become part of the denominator when the following criteria were met: a difference of 5 % when one of the values was less than 10 %; 10 % when both values were greater than 10 %; a difference of a cover class and 15 % at greater than cover class 3 (>25 %). Cover values of species form the second element in the denominator when the constancy requirement is met for one community and not for the other. Thus my denominator is the cover differences between the two communities, rather than the total cover used by the Motyka denominator.

Communities with perceived similarities were compared based on my field observations, their relative position on the ecological moisture regime scale, and the ordering of species in the vegetation table. I tested the plant communities from other studies against each other to determine the level of differentiation applied. These tests provided reference points for comparison with my study. It was necessary to use a lower presence requirement (≥ 0.61 (Class IV)) when that was the only level available approximating mine. These comparisons were developed from three other data sources, representing oak, savannah, and grassland communities from the Pacific Northwest. The Pacific Northwest is the larger geographic context for my study and the types in these data sources have the most similar physiognomy to that of the Garry oak vegetation.

3.153 Twinspan Classification (see 3.263)

A small subproject of the thesis work tested the use of the *TWINSPAN* software (Hill, 1979) as an "objective" classification and examined its hierarchical facility. *TWINSPAN* (Two Way Indicator Species Analysis, Hill, 1979) is a *FORTRAN* program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. It is a polythetic divisive method (Meidinger et al., 1987) which assigns plots first, then species, based on the plot classification. The aim is similar to that of Braun-Blanquet (1932) table work, to group "like species" and "like samples" together through repeated dichotomization. I reviewed *TWINSPAN* for its objectivity, hierarchy, statistical ability and whether it was used objectively in the literature (Erickson, 1994a).

3.16 Multiple Regression (see 3.27)

Exploratory multiple regression analyses were conducted on the 1993 data using *SPSS for WINDOWS* (Version 6.0). The relationships between a plant community gradient (dependent variable) and environmental variables (independent variables) were examined, together and separately. The plant community gradient was developed by numbering plant communities from 1 to 32 for their position in an ordered table, correcting for their relationships and their placement in disturbance sequences (see 4.1). Such a numbering procedure is similar to the starting point in some forms of vegetation ordination (Beals, 1973). Numeric scales were applied to seven environmental variables: percent surface rocks; surface shape; aspect; elevation; percent surface bedrock and/or shallow humus over bedrock; percent slope; and ecological moisture regime class. The adjusted R-square value and its derivative, percentage of variance accounted for, are the primary interpretation statistics for multiple regression. A relatively high subject-to-variable ratio (18:1) was maintained in order to preserve statistical reliability by minimizing shrinkage in the adjusted R-square values. Statistically, the sample domain was restricted to the confines of the plots actually sampled.

A general multiple regression assessed the ability of all predictors together to

account for variation in the plant community gradient and determined which predictors were the most important, with all the others taken into account. A Pearson Product Moment correlation examined the individual relationships between and among the predictors and the plant community gradient. This correlation was also a check for collinearity or cross-relationships between the predictors. A stepwise multiple regression entered each of the predictor variables separately in decreasing order of the amount of variation they accounted for, with all the others taken into account. I also examined ecological moisture regime class separately as a dependent variable, with a general multiple regression using the six other environmental variables.

3.2 DISCUSSION OF METHODS

3.21 Sampling Approach

The process of classification recognizes similarities, then groups objects (vegetation stands) together based on those similarities. This is an ancient tradition (Sokal, 1974). As well as adopting this tradition, I used two sequential methods known as "subjective sampling without pre-conceived (personal) bias" and "successive approximation". In these methods, working generalizations are reviewed or revised as new information is available (Poore, 1962; Daubenmire, 1968; Mueller-Dombois and Ellenberg, 1974). The process starts in the field, when typical, frequently occurring communities are selected as stands for sampling (Poore, 1962).

The subjective, or discriminate, site selection (Mueller-Dombois and Ellenberg, 1974) was similar to that used in European phytosociology, the biogeoclimatic ecosystem classification in British Columbia and the previous study of Roemer (1972). Though not always stated, these approaches assume some degree of uniformity within a geographic area in that similar sites will have similar communities. I did maintain this assumption, but to a lesser degree in my project, because my scope encompassed the variety of current vegetation, subject to the vagaries of disturbance. The U.S. oak woodland studies all used subjective methods (Thilenius, 1964, 1968; Williams, 1978; Smith, 1985; Sugihara et al., 1987; Riegel et

al., 1992). Probability sampling was reviewed and found to be not appropriate (Erickson, 1993d). Instead, successfully sampling Garry oak stands within their landscape mosaic required the flexibility and time efficiency of the subjective method. The large number (thousands) of plots required in probability sampling and statistically-sound multivariate analysis contraindicate the use of truly objective methods for projects of similar scope. Probability samples are not easily extrapolated to the physical landscape and therefore it can not be automatically assumed that they are ecologically meaningful. For example, the random plot placement may cut halfway across a plant community boundary, include two or several physical sites (e.g. knoll and swale) or include one-half with an oak canopy and the other half without. Subjective methods allow fitting plot placement to accommodate all these patterns which are widely recognized and accepted to have ecological significance. The broad scope of my objectives, the sharp contrasts of the study vegetation, the goal of grouping plant communities, the need for developing a classification comparable to other studies, and the requirement for an efficient sampling completion rate -- all reinforced the choice of the subjective method. This choice was similar to that made by other ecological field workers, such as Steele et al. (1983), who reject the use of random and systematic sampling procedures as "inefficient and impractical" for their study of the forest habitat types in eastern Idaho and western Wyoming.

Much of the field and analytical background for my study has roots in European phytosociology, via the biogeoclimatic ecosystem classification, which has prevailed in British Columbia (Krajina, 1965; Krajina and Brooke, 1969/70; Meidinger and Pojar, 1991). These systems emphasize species presence/absence. Parallels to my sampling approach are also provided by a history of U.S. Pacific Northwest work (Daubenmire, 1942, 1952, 1970; Franklin and Dyrness, 1973; Pfister et al., 1977; Steele et al., 1983), including some within British Columbia (Tisdale and McLean, 1957; McLean and Marchand, 1968; McLean, 1970; Annas and Coupe', 1979; Beese, 1981; Mitchell et al., 1981a and b; Lea et al., 1985; DeLong, 1988; Hamilton and Yearsley, 1988), and the various studies of U.S. *Q. garryana* woodlands (Thilenius, 1964, 1968; Williams, 1978; Sugihara et al., 1987; Smith, 1985; Riegel et

al., 1992). These studies tended to use cover for plant dominance, consistent with the "Anglo/ American" tradition. My use of dominance through plant cover conforms with this tradition, for example the dominance-types of Whittaker (1978b), as well with as the unifying comment of Walter (1979, p.19) on the "need to define each type of ecosystem by the dominants." Most of all I am reflecting my conclusion, derived from past experience, that it is inappropriate in a plant community classification to feature species with minor amounts of cover and uncertain consistency in presence.

3.22 Plot Selection

The use of the four main factors -- representativeness, replication, areal extent and homogeneity -- was consistent with the plot selection methods outlined in Walmsley et al. (1980). The selection of each plot was an attempt to obtain a high degree of uniformity in site and vegetation conditions. However, the range of plots represents a variety of age-class, stand-structure, and post-disturbance conditions. Where possible, plots were located to represent different sites with contrasting moisture regimes (Meidinger and Pojar, 1991). The homogeneity criteria required that the individual sites were within one apparent ecological moisture class with consistent vegetation. In addition, I accepted certain individual sites with a closely-linked combination of two classes and interrelated vegetation. Stands on shallow soil and rock were included, usually based upon the canopy zone of the oaks. Sites representing each geographic area were usually selected. However, a site with "first-fit" of the site selection criteria was often accepted, where the plant community was recognized from other areas within the ecological survey. This practise served to broaden the diversity sampled from the plant communities. The tactic of conducting a walking survey helped to avoid the effects of road edges, vegetation or soil disturbance in plot placement.

It was frequently not appropriate to employ standard 20 x 20 m plots (Walmsley et al., 1980). My strategy was to adjust the size and shape to match the plant community or site factors. For example, adjustments were usually required in sampling sites with large-crowned oaks having a broad zone of influence. In these

circumstances, rounded plot shapes were sometimes suitable. The need for curvilinear forms is suggested by the way canopy shadows are thrown across sites in concentric patterns by the daily arc of the sun (e.g. Canham et al., 1990). The sun's seasonal path during spring and summer creates an arc used by Horn (1971) as a major determiner of the light regime of a given spot. Both the reconnaissance method of Franklin et al. (1970) (employed in two of the comparative studies) and its modification by Douglas (1974) used round plots. In/out decisions for species are minimized by the round perimeter area. Visualizing boundaries is more difficult, but flexibility in plot shape is suggested by a number of authors (e.g. Knapp 1984c; Kuchler 1988; Pojar et al., 1991).

Large plot sizes, for example --20 X 20 m --, were recommended as meeting the "minimal area requirement" for stand sampling both in British Columbia and for temperate deciduous forests in general (Walmsley et al., 1980; Knapp 1984c; Westhoff and van der Maarel, 1978; Pojar et al., 1991). Large plots were used in many of the comparative studies (Williams, 1978; Sugihara et al., 1987; Riegel et al., 1992). Saturation on the species/area curves for oak vegetation occurred at much less than 256 m² in the study of Roemer (1972). My plots were normally between 70 m² and 300 m². Their size was intended to address the suggested minimal area requirement, thereby avoiding the sampling of plots too small for plant communities to be fully expressed (known as vegetation fragments -- Braun-Blanquet, 1932). My acceptance of plant communities for the purposes of this study was a practical decision consistent with relevant literature (e.g. Daubenmire, 1968; Mueller-Dombois and Ellenberg, 1974; Whittaker, 1978a). Many field ecologists have found the concept to be a useful tool which imparts a level of knowledge and organizes ecological relationships.

3.23 Reconnaissance Plot Method

Other researchers have developed and applied reconnaissance plot methods (Poore, 1955c; McVean and Ratcliffe, 1962; Burnett, 1964b; Thilenius, 1964; Daubenmire, 1968; Franklin et al., 1970; Douglas, 1974; Pfister and Arno, 1980; Steele et al., 1983; Riegel et al., 1992). Douglas (1974) made a comparison with more

intensive sampling and found that his reconnaissance method provided an adequate estimate of stand composition. Completion rates for reconnaissance and intensive sampling are also revealing. Thilenius (1964) indicates that 47 stands for full plot work vs. 140 stands for reconnaissance sampling could be completed with an apparently comparable effort and result.

My "desired" sampling level of ten different plots per reconnaissance cover type (Kuchler, 1988) was also the standard used as a working objective for the sampling for the biogeoclimatic ecosystem classification of the British Columbia Ministry of Forests, although Pojar et al. (1991) ascribed a lower number, 5, as a desired level. The "minimum" sampling level of 3 was established from past experience and in recognition of practical realities. Although Roemer (1972) recommended 60-70 replicates for each of his Garry oak communities (associations), this level would not have been attainable for my study.

The use of canopy cover as a measure of species dominance was supported by the comment of Knapp (1984b, p.77) that "species coverage seems to be the most meaningful parameter for the quantitative representation of species in the plant community stand." Cover classes adequately address the level of accuracy necessary for classification purposes. They provide a quick and reliable means of comparing the large amount of information required. Even the use of a 5-class cover scale provides sufficient information for the delineation and typification of communities (Daubenmire, 1968; Pakarinen, 1984). Many parallel studies used Daubenmire (1959) for cover classes. Three of the comparative studies used the Braun-Blanquet (1932) classes (Aldrich, 1972; Roemer, 1972 and Sugihara et al., 1987), with the remainder and Walmsley et al. (1980) using direct percent canopy cover estimates (Thilenius, 1968; Williams, 1978; Smith, 1985; Riegel et al., 1992). High cover species are the easiest to detect. The emphasis of my classification on cover therefore focuses on those species which are easily found in ecological survey work. This emphasis, together with established internal rules for sampling and keying out communities, should increase the reliability of the classification.

Soil descriptions were restricted to surface horizons for efficiency and in

deference to the predominant influence of these horizons for the typical, shallow rooted herbaceous species. *Ah* horizons are the surface horizons which are particularly characteristic and important in this habitat (Roemer, 1972; Broersma, 1973, Valentine et al., 1978).

3.24 Forms and Vegetation Data

The 6-class canopy coverage scale I developed (Table 3) differs from related scales (Braun-Blanquet, 1932; Daubenmire, 1959; and Klinka et al., 1984, 1989) in the threshold levels and the conversion of class limit mid-points into whole numbers. It is necessary to estimate to the nearest percent cover only near the class limits. For example, observed cover will be assigned to either 1% or 2%, the same as in direct percent cover estimates (Walmsley et al., 1980), before recording by cover class. The scale pays less attention to small amounts of cover and adds more detail and ease of estimation for moderate covers, with the 11 % threshold.

I felt the inclusion of all ground layer non-vascular cryptogam species was not justified in the "reconnaissance plot" approach. The efficiency of the work was a factor, but the decision also reflected their micro-scale occurrence and the difficulties of detection and identification. Covers 1% and below probably need a different sampling design. Mosses and lichens have been relatively unimportant in classification work. Including dominant cryptogams is warranted, however. There had been, for example, three prominent species in the list described by Roemer (1972). Lichens have been studied for the coastal Douglas-fir zone by Noble (1982) and for Saltspring Island (including epiphytic species on Garry oak) by Bird and Bird (1973). Epiphytic cryptogams were not included in my study, as they appear to be quite independent of the plant community. The epiphytic mosses and lichens of Garry oak have also recently been the subject of a focused study (Ryan, 1991).

I developed informal plant phenology charts from several sources of information (Pavlick, 1986; Jolly, 1988; Merilees, 1993) to aid the sampling and comparison of stands across the various stages of plant development. Although vegetation was ordinarily sampled at a time corresponding to peak vegetation cover

development, the allowance for both early- and late- season sampling should extend the usefulness of the study results. The early-season sampling characterized the showy native flower types of the Garry oak habitat, which are one of the primary interests of the public. It was also important to include the late-season community, which persists through the greater part of the calendar year, particularly the grass component. Presence and dominance can still be interpreted beyond peak vegetative growth. More sampling across the range and variation of the plant communities was completed with this temporal flexibility.

3.25 Environmental Data and Other Information

The use of environmental attributes for description aided further understanding of the plant communities. Ecological moisture regime (Walmsley et al., 1980) was emphasized in descriptions because it is thought to be the primary integrator which unifies and expresses the combined influence of environmental site conditions. The addition of two classes, "very xeric" and "permesic", as well as intergrades, to this relative scale should increase the descriptive and any "predictive" powers of the concept.

3.26 Classification

The process maintained a "natural" classification (*sensu* Sokal, 1974), developed from the field experience and data collected, rather than a framework adopted from the literature. This followed a recent precedent from the very ambitious British Plant Communities project (Rodwell, 1991). My classification methods were generally founded on European "tablework", as it developed further in British Columbia, but with differences. For example, ranking (determining the hierarchical status of taxa), the primary focus of the European efforts (Mueller-Dombois and Ellenberg, 1974), was not an objective.

Classification was also an objective for a number of comparative oak woodland studies, but their work often followed different traditions. Many of the more recent works used automated classification methods, such as *TWINSPAN* (Hill,

1979), which was examined as a small sub-project of the thesis work and is discussed in 4.14. Other influences were Roemer's (1972) application of the European approach for the Victoria area and the main efforts of ecological classification in British Columbia (Krajina, 1965; Krajina and Brooke, 1969/70; Pojar et al., 1987; Meidinger and Pojar, 1991). However, these methodologies not only use presence rather than cover, but they accept low thresholds (presence class III: 41% to 60%) to include species as taxonomic elements in the classification (e.g. Brooke et al., 1970; Pojar et al., 1987). The result is that when sites are visited, the species for which the plant community is partly defined are frequently not present. This raises questions of utility and reliability in plant community detection.

My classification ensured the preeminent role of plant dominance through the use of cover in the subjective grouping methods, the constant cover value, and the adjusted Motyka coefficient. Whether to "split" or "lump" has always been an issue in subjective classification. I emphasized "splitting", in keeping with the major new focus on biodiversity and community diversity in conservation biology (e.g. Lertzman, 1993; Salwasser, 1993). "Splitting" recognizes diversity and hence potentially leads to its preservation. My degree of differentiation ("splitting" or "lumping") was compared with other classification from the Pacific Northwest using the adjusted Motyka coefficient. Hierarchical structure was minimized in the interest of keeping the classification structure simple and "non-taxonomic". These approaches were conditioned by my own previous experience, including the 875-plot Okanagan ecosystems project (Erickson, 1982, 1984a and b). Other salient features were the inclusion of disturbed communities; the biogeographic links to the U.S. and need for comparison with the U.S. types; and the need to recognize plant communities easily using cover. Easy recognition should facilitate ready communication to naturalist volunteers and professionals. Implementing the classification should be enhanced by this greater understanding.

3.261 Constant Cover Value Index

I developed the Constant Cover Value Index as an assurance that the constant species (mean presence of 0.70 or more) accounted for an adequate proportion of the total cover in the community groupings. Adequacy was judged subjectively through a review of the array of values and the status of any communities with lower index values, as discussed in the results (4.12). The application of this index reflects my emphasis on plant species dominance through cover. The constant cover value index can be seen as a separation and re-focusing of the denominator from the Motyka index of similarity (Mueller-Dombois and Ellenberg, 1974), applying it as a "within-type" rather than a "between-type" measure.

3.262 Adjusted Motyka Coefficient

The Motyka index of similarity (Mueller-Dombois and Ellenberg, 1974) provided an appropriate basis for comparison because it uses cover as the numeric value. It was necessary to adjust this index of similarity to encompass my classification criteria and approximate my cover classes. This was done by changing the denominator to the cover differences between the community pair, as described in 3.151. The levels chosen in defining these differences also reflected my field observations of the cover values of dominant species from previous experience, as well as the sort of recognition built into the *TWINSPAN* software in its use of pseudospecies for cover levels (Hill, 1979). The old denominator, total cover, from the Motyka index of similarity was unacceptable as it did not actually contribute to the "between" comparison. Total cover is a "within" comparison measure. Communities with a low cover of constant species would register as dissimilar, not because of differences but because of a large denominator derived from total cover.

The adjusted Motyka coefficient was applied in a computer-assisted fashion using the *EXCEL* software. For this reason I could not conduct an "all-by-all" comparison, and therefore I compared selected pairs from adjacent communities on the tables and many other pairs which I suspected might be similar. The comparison from other Pacific Northwest studies also used adjacent pairs from community tables.

My intention was to evaluate my communities using the coefficient values and consider any suggestive results. This is not a means of classification but an aid to classification. For units within my classification I considered regrouping as necessary.

To review the level of differentiation in my classification as a whole I applied the coefficient to community pairs from outside data sources and then compared the values. I chose community pairs from grasslands, savannah and oak woodlands in the Pacific Northwest. These were sources which provided both cover and presence values, had generally similar physiognomy to my types and formed the context for my study results.

3.263 Twinspan Classification

TWINSPAN was selected because it is potentially objective, provides a hierarchy and is widely used in vegetation ecology. Testing its use was an attempt to identify a suitable "objective" classification which might have confirmed or provided suggestions for my subjective classification. This possibility was approached cautiously (tested) because it was not part of the design of my study and in recognition of the difficulties inherent in trying to achieve pure objectivity. Testing the objective use of the program in the literature was important because this would be the context for the automated classification results. The statistical ability of the program is an element for investigation because it determines the reliability of the classification results.

3.27 Multiple Regression

Multiple regression and correlation procedures were conducted to examine the relationship between the plant community gradient and a selected number of key environmental variables at a descriptive level. The sample domain was restricted to the sites actually sampled in recognition that my subjective site selection prevented wider extrapolation. The number of environmental variables for the analysis had to be kept down in order to maintain the reliability of the result with an adequate subject-to-variable ratio. Environmental variables had been measured or estimated on site, although ecological moisture regime is a composite variable, encompassing

the other environmental variables plus several additional ones. Ecological moisture regime can be assessed with these factors alone (Walmsley et al., 1980), as done, for example, by the pedologist on the sampling team for the biogeoclimatic ecosystem classification in British Columbia.

Multiple regression is an analytical tool dealing with correlation of multiple variables. It does not require independence of the variables under investigation and is not concerned with causation (as are experiments designed for orthogonality). My use of multiple regression/ correlation was exploratory because it was an afterthought, being neither part of my design nor a test of a specific hypothesis. Ecological moisture regime was expected to be the top-ranking "predictor". Examining ecological moisture regime class as a dependent variable was intended to test the influence of the six other environmental variables in the assessment of this subjectively derived variable.

CHAPTER 4: RESULTS

4.0 GENERAL RESULTS

Three hundred and forty (340) plot descriptions were completed, consisting of 135 in 1994, 152 in 1993, and 53 in 1992. Most of the main range of Garry oak in British Columbia was covered in the 125 geographic areas sampled for plots (Figure 3, Appendix 3). The 1992 plots (53) were treated as general reconnaissance, as I felt I had obtained an adequate number of samples for the tablework in the two following years. However, the 1992 plots in British Columbia were classified and this is shown in Appendix 4.

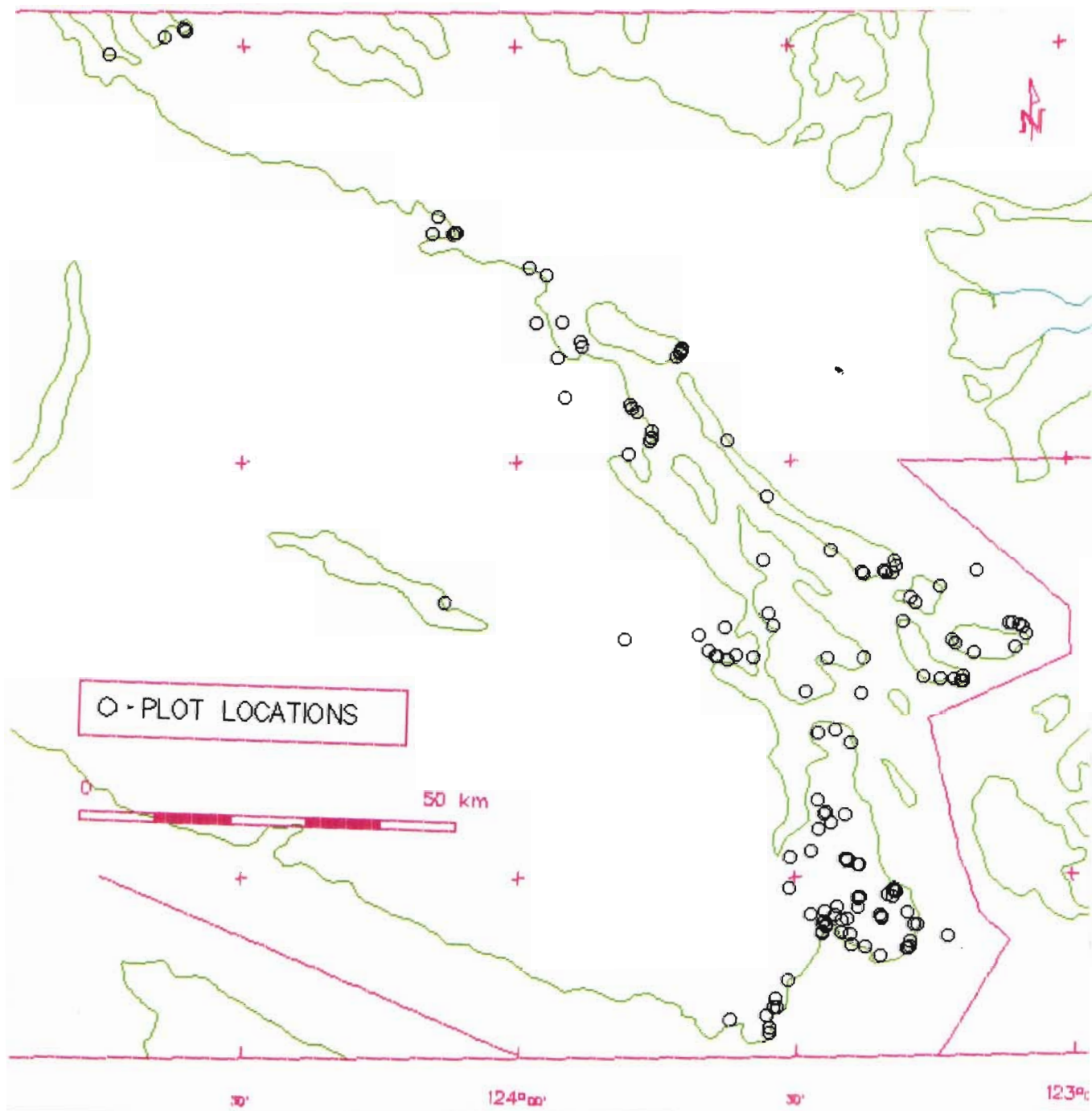
4.1 OVERVIEW OF THE PLANT COMMUNITIES

Forty-three (43) plant communities are recognized and characterized. They are described in detail with their ecosystems in Chapters 5 and 6. A key is provided in 4.11. These communities are summarized in three ways: in numerical sequence (Appendix 5), grouped by classification (Appendix 6), and grouped into six consolidated categories (Figure 4 to 7; Appendix 7), which formed the basic sequence used throughout. The consolidated categories are a means of organizing the communities and do not represent a classification. The terms "first-order" and "second-order" disturbance communities reflect the apparent sequence of vegetation change and site disturbance following the introduction of non-indigenous species by European colonists (see 2.5). The use of alpha-numeric designations for the plant communities provides a cross-reference mechanism to my sequential data files and a short form for representing the communities. Plant community summary tables are found in Appendix 8. Photographs are displayed in Appendix 9. Tables with all species included are located in Appendix 10.

The six consolidated categories give an idea of the nature of diversity in the Garry oak communities. Three native and three non-native divisions are recognized. Of the native groupings, there were seven early-season plant communities (with early peak vegetation cover growth between April 1 and May 15), four native plant

Figure 3. Plot Location Areas

(each circle represents 1 to 10 plots)



EARLY SEASON

Oak- *Camassia quamash*: Typic subcommunity (c37a)

Oak- *Camassia quamash*-*Erythronium oregonum* subcommunity (C35a)

Oak- *Camassia quamash*-*Dodecatheon hendersonii* subcommunity (c35b)

Oak- *Camassia quamash*-*Ranunculus occidentalis* subcommunity (c37b)

Oak- *Camassia leichtlinii* (c36)

Oak- *Montia perfoliata* (c48)

Oak- *Dicranum scoparium*-*Plectritis congesta* subcommunity (c51)

BEDROCK OUTCROPS

Oak- *Dicranum scoparium*- *Montia parviflorum* subcommunity (c11)

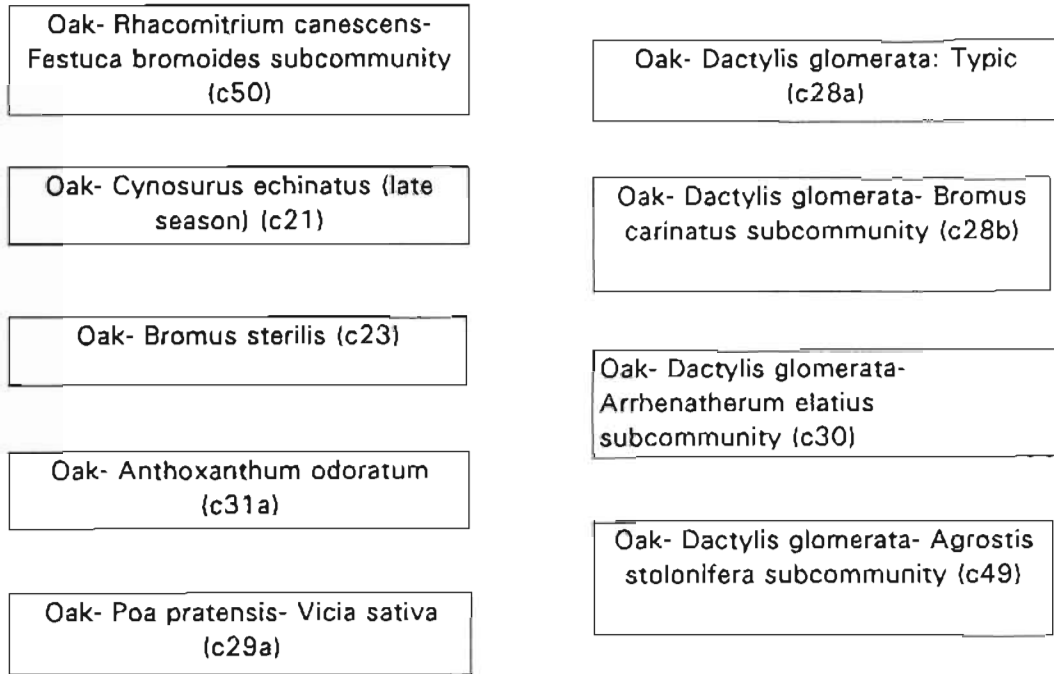
Oak- *Dicranum scoparium*- *Sedum spathulifolium* subcommunity (c45)

Oak- *Dicranum scoparium* Typic (c52)

Oak- (Fd)- *Rhacomitrium canescens*- *Selaginella wallacei* subcommunity (c46)

Oak- *Dicranum scoparium*-*Plectritis congesta* subcommunity, early season (c51)

Oak- Mahonia aquifolium (c26)	Oak- Bromus carinatus (c43)
Oak- Lonicera hispidula (colluvium) (c16a)	Oak- Carex inops (c14)
Oak- Festuca idahoensis: Typic subcommunity (c20)	Oak- Melica subulata (c13)
Oak- Festuca idahoensis- Cerastium arvense subcommunity (c25)	Oak- Holodiscus discolor- Symphoricarpos albus- Polypodium glycyrrhiza (c15)
Oak- Festuca idahoensis- Trifolium microcephalum subcommunity (c27)	Oak- (Fd)- Holodiscus discolor- Symphoricarpos albus- Rhytidiadelphus triquetris (c10)
Krummholz Oak- Festuca idahoensis- Vicia americana, subcommunity (c42)	Oak- Symphoricarpos albus- Rosa nutkana- Lonicera ciliosa subcommunity (thickets) (c8)
Oak- Elymus glaucus (c47)	Oak- Symphoricarpos albus- Rosa nutkana- Oemleria cerasiformis- subcommunity (thickets) (c9)
Oak- Lathyrus nevadensis (c41)	



ROCK OUTCROPS

OTHER COMMUNITIES

Oak- Broom- Rhacomitrium
canescens-Festuca bromoides- Aira
subcommunity (c3)

Oak- Broom- Cynosurus echinatus
(late season) (c2)

Oak- Broom- Rhacomitrium
canescens: Typic subcommunity
(c17)

Oak- Broom- Anthoxanthum
odoratum (c31b)

Oak- Broom- Rhacomitrium
canescens- Bromus tectorum
subcommunity (c22)

Oak- Broom- Elymus glaucus (c6)

Oak- Broom- Poa pratensis (c4)

Oak- Broom- Dactylis glomerata
(c5)

communities of rock outcrops and 15 other native plant communities encompassing the rest of the sequence of moisture conditions. The non-native plant communities roughly parallel this pattern. They are divided into two portions according to the timing and degree of disturbance leading to their composition. A "First-Order Disturbance" group without broom (*Cytisus scoparius*) dominance and has nine plant communities. A "Second-Order Disturbance" group is with broom (*Cytisus scoparius*) dominance, consisting of three rock-outcrop communities and five others from less-severe moisture condition sites.

Ten communities had at least 10 plots, meeting the "desired" sampling objective. Twenty-three communities had between 5 and 9 plots; and 10 communities had 3 or 4 plots, meeting the "minimum" sampling requirement of 3 plots. The latter were generally from one of two situations, either they were detected late in the sampling or they occurred infrequently.

I did not adopt a taxonomic classification framework, instead assigning the term "plant community" for the basic units. Physiognomic, site, or other features are included in community names, where particularly striking. Plant "subcommunity" was added where considered necessary on subjective grounds or because of the adjusted Motyka comparison results. Subcommunities were delineated for additional plant species different from those the community was originally named for, which was retained as the "Typic" subcommunity. The typic subcommunity is therefore defined by the lack of the named species from other subcommunities. This use of the term follows that in both the U.S. and Canadian (subgroups within the Organic Order) systems of soil classification (Soil Survey Staff, 1975; Canada Soil Survey Committee, 1978). I have retained the term plant community for referring to these units (communities and subcommunities) in general.

More plant community diversity was encountered than the 15-30 types anticipated. There was a wider series of native plant communities, and a fairly full sequence of two types of disturbance communities. Some of this diversity is thought to be controlled by the variation in climatic conditions and vegetation history across the region covered by the study.

4.11 Key to the Plant Communities

SYNOPSIS OF KEY

A. Early season classification¹

Camassia quamash usually dominant:
CHOOSE THE FIRST OF THE 4 SUBCOMMUNITIES WHICH FITS

CHOOSE THE FIRST OF THE 3 REMAINING COMMUNITIES WHICH FITS

B. Later season classification

1a: Mostly native dominant species...

1a: Bedrock landscapes...

Rhacomitrium canescens...

CHOOSE THE FIRST OF THE 4 SUBCOMMUNITIES WHICH FITS

Dicranum scoparium...

CHOOSE THE FIRST OF THE 4 SUBCOMMUNITIES WHICH FITS

1b: Dominated by dense cover of native shrubs

Rosa nutkana...

CHOOSE THE FIRST OF THE 2 SUBCOMMUNITIES WHICH FITS

CHOOSE THE FIRST OF THE 2 REMAINING COMMUNITIES WHICH FITS

1c: Dominated by native herbaceous vegetation

Festuca idahoensis...

CHOOSE THE FIRST OF THE 4 SUBCOMMUNITIES WHICH FITS

CHOOSE THE FIRST OF THE 5 REMAINING COMMUNITIES WHICH FITS

1d: Previous criteria not met, dry colluvial sites, native shrubs

CHOOSE THE FIRST OF THE 2 COMMUNITIES WHICH FITS

2: Mostly introduced dominant species... broom absent or...

Dactylis glomerata ...

CHOOSE THE FIRST OF THE 4 SUBCOMMUNITIES WHICH FITS

CHOOSE THE FIRST OF THE 4 REMAINING COMMUNITIES WHICH FITS

3: Broom dominant...

3a: Bedrock landscape...

Rhacomitrium canescens...

CHOOSE THE FIRST OF THE 4 SUBCOMMUNITIES WHICH FITS

3b: Other broom sites, dominated primarily by herbaceous...

CHOOSE THE FIRST OF THE 3 COMMUNITIES WHICH FITS

CHOOSE THE FIRST OF THE 3 *Dactylis glomerata* SUBCOMMUNITIES WHICH FITS

CHOOSE THE FIRST OF THE 2 REMAINING COMMUNITIES WHICH FITS

C. Repeat key if community not found

¹ Stands are to be keyed in the early season section between April 1 and May 15 or when plant phenology allows. Once keyed to an early season plant community, a site may also be keyed to a later season classification and have two identified plant communities.

Facultative Key to Garry Oak Plant Communities:

.....
 This key is primarily to be applied where Garry oak (*Quercus garryana*) is dominant in at least one layer, secondarily where it is co-dominant or subdominant. The reference to "other species" in the key alludes only to those in this key. Percent cover values are given here for convenience only. The cover classes outlined in Methodology and used in the plant community chapters (5 & 6) are recommended for use. Stands of vegetation are to be classified into one or both of the two time interval classes shown ahead.

A. Early-season classification, April 1 to May 15: early-season plant communities defined by herbaceous vegetation, especially bulb-forming species: broom (*Cytisus scoparius*) present or absent²; (if not see B.)

A1a *Camassia quamash* usually dominant: (if not see **A1b**)

A1a1 *Erythronium oreganum* usually $\geq 11\%$ cover, *Camassia quamash* usually $\geq 11\%$ cover: **c35a** Oak - *Camassia quamash* - *Erythronium oreganum* subcommunity
 (if not see **A1a2**)

A1a2 *Dodecatheon hendersonii* $\geq 11\%$ cover, *Camassia quamash* usually $\geq 11\%$ cover: **c35b** Oak - *Camassia quamash* - *Dodecatheon hendersonii* subcommunity
 (if not see **A1a3**)

A1a3 *Ranunculus occidentalis* $\geq 11\%$ cover, *Camassia quamash* usually $\geq 11\%$ cover: **c37b** Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity
 (if not see **A1a4**)

A1a4 previous three sets of criteria not met, *Camassia quamash* usually $\geq 11\%$ cover: **c37a** Oak - *Camassia quamash*: Typic subcommunity (if not go to **C**)

A1b *Plectritis congesta* $\geq 11\%$ cover, *Dicranum scoparium* usually $\geq 11\%$ cover, bedrock landscapes: **c51** Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (if not see **A1c**)
 (also in the key below)

A1c *Montia perfoliata* $\geq 11\%$ cover: **c48** Oak - *Montia perfoliata*
 (if not see **A1d**)

² Stands are to be keyed in the early season section between April 1 and May 15 or when plant phenology allows. Once keyed to an early season plant community, a site may also be keyed to a later season classification and have two identified plant communities.

A1d *Camassia leichtlinii* \geq 11% cover: c36 Oak - *Camassia leichtlinii*
(if not see **B**.)

B Later season classification (generally after May 15): Continue in the key to add classification where not determined in previous step³: (if not go to **C**.)

1 Mostly native dominant species, broom absent or of secondary importance \leq 11 to 15% cover (low cover class 3): (if not, go to **2**.)

1a Bedrock landscapes, units defined by combinations of mosses and herbaceous vegetation: (if not, go to **1b**.)

1a1 *Rhacomitrium canescens* usually dominant, south- and west-facing slopes: (if not, go to **1a2**.)

1a1a *Selaginella wallacei* and/or *Rhacomitrium canescens* \geq 11% cover, the other of which $>$ 2% cover: c46 Oak - *Rhacomitrium canescens* - *Selaginella wallacei* subcommunity
(if not, go to **1a1b**.)

1a1b *Festuca bromoides* and/or *Rhacomitrium canescens* \geq 11% cover, the other of which $>$ 2% cover: c50 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity
(if not, go to **1a1c**.)

1a1c *Bromus tectorum* \geq 11% cover, *Rhacomitrium canescens* usually \geq 11% cover (often $>$ 51%): c22 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum* subcommunity (if not, go to **1a1d**.)
(also in the key below)

1a1d previous three sets of criteria not met, *Rhacomitrium canescens* \geq 26% cover, $>$ other species: c17 Oak - Broom - *Rhacomitrium canescens*: Typic subcommunity (if not go to **C**.)
(also in the key below)

³ Stands are generally to be keyed in the later season section after May 15, or when plant phenology allows. Once keyed to a later season plant community, a site may also be keyed to an early season classification and have two identified plant communities.

1a2. *Dicranum scoparium* usually dominant, usually north- and east- facing slopes: (if not, go to 1b.)

1a2a. *Montia parvifolia* \geq 11% cover, *Dicranum scoparium* usually \geq 11% cover: c11 Oak - *Dicranum scoparium* - *Montia parvifolia* subcommunity (if not, go to 1a2b.)

1a2b. *Plectritis congesta* \geq 11% cover, *Dicranum scoparium* usually \geq 11% cover: c51 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (also in the early-season key) (if not see 1a2c.)

1a2c. *Sedum spathifolium* \geq 11% cover, *Dicranum scoparium* usually \geq 11% cover: c45 Oak - *Dicranum scoparium* - *Sedum spathulifolium* subcommunity (if not see 1a2d.)

1a2d. previous three sets of criteria not met, *Dicranum scoparium* \geq 11% cover: c52 Oak - *Dicranum scoparium*: Typic subcommunity (if not go to C.)

1b. Dominated by dense cover of native shrubs (thickets):
(if not see 1c.)

1b1. *Rosa nutkana* usually dominant: (if not see 1b2.)

1b1a. *Lonicera ciliosa* and/or *Rosa nutkana* \geq 11% cover, the other of which \geq 2%: c8 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (if not see 1b1b.)

1b1b. *Oemleria cerasiformis* and/or *Rosa nutkana* \geq 11% cover (usually $>$ 26%), the other of which $>$ 2%: c9 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity (if not go to C.)

1b2. *Rhytidiadelphus triquetris* and/or *Holodiscus discolor* \geq 11% cover (usually $>$ 26%), rocky substrate: c10 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadelphus triquetris* (if not see **1b3.**)

1b3. *Polypodium glycyrrhiza* \geq 11% cover, usually with *Holodiscus discolor* and/or *Symphoricarpos albus* \geq 11% cover, bedrock landscape: c15 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza* (if not go to **1c.**)

1c. Dominated by native herbaceous vegetation:
(if not go to **1d.**)

1c1. *Festuca idahoensis* usually dominant: (if not see **1c2.**)

1c1a. *Vicia americana* \geq 2 % cover (usually \geq 11%), *Festuca idahoensis* often \geq 11% cover, seaside location, usually krummholz oak form: c42 Krummholz Oak - *Festuca idahoensis* - *Vicia americana* subcommunity (if not see **1c1b.**)

1c1b. *Trifolium microcephalum* \geq 11% cover, *Festuca idahoensis* usually \geq 11%: c27 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity (if not see **1c1c.**)

1c1c. *Cerastium arvense* \geq 11% cover, *Festuca idahoensis* usually \geq 11%, other species \leq 11%: c25 Oak - *Festuca idahoensis* - *Cerastium arvense* subcommunity (if not see **1c1d.**)

1c1d. previous three sets of criteria not met, *Festuca idahoensis* \geq 11% cover, other species \leq 11% : c20 Oak - *Festuca idahoensis*: Typic subcommunity (if not go to **1c.**)

1c2. *Lathyrus nevadensis* \geq 11% cover, other species various: c41 Oak - *Lathyrus nevadensis* (if not see **1c3.**)

1c3. *Bromus carinatus* \geq 11% cover, other species various: c43 Oak - *Bromus carinatus* (if not see **1c4.**)

1c4. *Elymus glaucus* \geq 11% cover, \geq other herb species: c47 Oak - *Elymus glaucus* (if not see **1c5.**)

1c5. *Melica subulata* \geq 11% cover, \geq other species: c13 Oak - *Melica subulata* (if not see **1c6.**)

1c6. *Carex inops* \geq 11% cover, \geq other species: c14 Oak - *Carex inops* (if not go to **C.**)

1d. Previous criteria sets not met, dry, colluvial sites, dominated by native shrubs: (if not go to **C.**)

1d1. *Lonicera hispidula* \geq 11% cover \geq other species: c16a Oak - *Lonicera hispidula* (colluvial) (if not see **1d2.**)

1d2. *Mahonia aquifolium* \geq 11% cover \geq other species: c26 Oak - *Mahonia aquifolium* (if not go to **C.**)

2. Mostly introduced dominant species, or mixed with native secondary dominants, broom absent or of secondary importance \leq 11-15% (low class "3"): (if not see **3.**)

2a. *Dactylis glomerata* usually dominant: (if not see **2b.**)

2a1. *Bromus carinatus* \geq 11% cover, *Dactylis glomerata* \geq 26% \geq other species: c28b Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity (if not see **2a2.**)

2a2. *Arrhenatherum elatius* \geq 11% cover, *Dactylis glomerata* \geq 11% cover, either \geq other species: c30 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity (if not see **2a3.**) (also in the key below)

2a3. *Agrostis stolonifera* \geq 11% cover, *Dactylis glomerata* usually \geq 11%, either \geq other species: c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity (if not see **2a4.**) (also in the key below)

2a4. previous three sets of criteria not met, *Dactylis glomerata* \geq 11% cover \geq other herb species: c28a Oak - *Dactylis glomerata*: Typic subcommunity (if not go to **C.**)

2b. *Cynosurus echinatus* \geq 26% cover, \geq other species:
c21 Oak - *Cynosurus echinatus* (late-season) (if not see **2c.**)

2c. *Bromus sterilis* \geq 11% cover, usually \geq 26%: **c23** Oak -
Bromus sterilis (if not see **2d.**) (also in the key below)

2d. *Anthoxanthum odoratum* \geq 11% cover, usually \geq 26%,
 \geq other species: **c31a** Oak - *Anthoxanthum odoratum* (if not
 see **2e.**)

2e. *Poa pratensis* and/or *Vicia sativa* \geq 11% cover, \geq other
 herb species: **c29a** Oak - *Poa pratensis* (if not go to **C.**)

3. Broom dominant, \geq 15% cover, ($>$ low class "3"), usually $>$ 26%:
 (if not go to **C.**)

3a. Bedrock landscape, dominated by combinations of mosses
 and herbaceous vegetation: (if not see **3b.**)

3a1. *Rhacomitrium canescens* usually dominant,
 \geq 26% cover: (if not see **3b.**)

3a1a. *Bromus tectorum* \geq 11% cover,
Rhacomitrium canescens usually \geq 11%
 (often $>$ 51%): **c22** Oak - Broom -
Rhacomitrium canescens - *Bromus tectorum*
 subcommunity (if not see **3a1b.**)
 (also in the key above)

3a1b. *Festuca bromoides* \geq 11% cover, \geq other
 species, *Rhacomitrium canescens* usually \geq
 11%: **c3** Oak - Broom - *Rhacomitrium canescens* -
Festuca bromoides - *Aira* subcommunity
 (if not see **3a1c.**)

3a1c. *Rhacomitrium canescens* \geq 26% cover, $>$
 other species: **c17** Oak - Broom - *Rhacomitrium*
canescens: Typic subcommunity (also in the key
 above) (if not go to **C.**)

3b. Other broom sites, dominated primarily by introduced
 herbaceous vegetation: (if not go to **C.**)

3b1. *Elymus glaucus* \geq 11% cover: c6 Oak - Broom - *Elymus glaucus* (if not see **3b2**.)

3b2. *Cynosurus echinatus* \geq 11% cover, \geq other species, late-season plant community: c2 Oak - Broom - *Cynosurus echinatus* (if not see **3b3**.)

3b3. *Anthoxanthum odoratum* \geq 11% cover (usually \geq 26%) \geq other species: c31b Oak - Broom - *Anthoxanthum odoratum* (if not see **3b4**.)

3b4. *Dactylis glomerata* usually dominant: (if not see **3b5**.)

3b4a. *Dactylis glomerata* \geq 11% cover, (usually \geq 26%) \geq other species: c5 Oak - Broom - *Dactylis glomerata* (if not see **3b4b**.)

3b4b. *Arrhenatherum elatius* \geq 11% cover, *Dactylis glomerata* \geq 11% cover, either \geq other species: c30 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity (if not see **3b4c**.) (also in the key above)

3b4c. *Agrostis stolonifera* \geq 11% cover, *Dactylis glomerata* usually 11%, either \geq other species: c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity (if not go to **C**.) (also in the key above)

3b5. *Poa pratensis* \geq 11% cover, (usually \geq 26%) \geq other species: c4 Oak - Broom - *Poa pratensis* (if not see **3b6**.)

3b6. *Bromus sterilis* \geq 11% cover, usually \geq 26%: c23 Oak - *Bromus sterilis* (if not go to **C**.) (also in the key above)

C. Repeat key and obtain best "fit". If there is no "fit", note as an unrecognized community.

4.12 Constant Cover Value Index

The Constant Cover Value Index (see 3.151) gives the proportion of the cover of the constant species in relation to the total cover for each plant community. This test is important in checking whether the classification has accounted for a sufficient amount of total cover. Results are shown in the following table and outlined for each plant community in the ecosystem descriptions in Chapters 5 and 6.

Table 5 Constant Cover Value Index Results

0.89 c50 (3 plots)	0.83 c51 (3)	0.83 c31b (3)	0.76 C22 (4)
0.75 c3 (10)	0.71 c17 (3)	0.71 C4 (5)	
0.68 c35b (4)	0.64 c28b (5)	0.64 C5 (5)	0.62 c27 (4)
0.60 C2 (6)	0.58 C11 (7)	0.54 c10 (5)	0.53 C6 (6)
0.52 c30 (5)	0.51 c41 (5)	0.51 c46 (4)	0.50 c9 (10)
0.50 c26 (4)	0.50 c52 (4)	0.49 c31a (7)	0.49 C15 (9)
0.48 c21 (9)	0.47 C8 (11)	0.46 c29a (14)	0.45 c28a (16)
0.45 C23 (9)	0.44 c25 (6)	0.43 c43 (6)	0.42 c35a(5)
0.41 c20 (7)	0.40 C13 (12)	0.40 c48 (12)	0.39 c42 (6)
0.38 c16a (9)	0.37 c36 (50)	0.34 c14 (6)	0.34 C45 (5)
0.34 c49 (5)	0.34 c37b (6)	0.27 c47 (14)	0.24 c37a (12)

(values are in bold, plant communities are given by their alpha-numeric designation)

A value of 1.0 would be obtained if the constant species of the community had all of the cover, a situation which I would consider suspect. Minimum values might be as low as 0.0 for a community from a phytosociological classification using presence classes with lower classification standards. My constant cover value index results range from 0.89 to 0.24, arranged from highest to lowest. The communities with higher index values have a larger proportion of their total cover contributed by species which are constant (mean presence > 0.70). In general, the higher the index value, the 'better' the grouping. However, the ideal range appeared to be between 0.40 and 0.70, which included 27 of the 43 communities. There were seven communities with higher values and nine with lower values. Most of the higher values (>0.70) are from communities dominated by broom or found on special habitats such as bedrock outcrops. The high values for the broom types can be considered a

"swamping" effect of high broom cover.

Most of the lower values (<0.40) represent native plant communities (Oak - *Carex inops* (c14), Oak - *Dicranum scoparium*- *Sedum spathulifolium* (c45), Oak - *Elymus glaucus* (c47)), of which several are the early-season herbaceous types (Oak - *Camassia leichtlinii* (c36), Oak - *Camassia quamash*: Typic subcommunity (c37a), and Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity (c37b)). Keeping these communities is consistent with my emphasis on native species to meet conservation biology objectives (British Columbia Ministry of Forests, 1995; see 1.3). Grouping broom and non-broom plots together led to the low values for the one non-native community, Oak- *Dactylis glomerata*- *Agrostis stolonifera* (c30). I am maintaining this community to support my reconnaissance observations and allow the moistest of the *Dactylis glomerata* subcommunities to be depicted. No changes were made as a result of the constant cover value index, for the reasons previously discussed.

4.13 Adjusted Motyka Coefficient Results

The adjusted Motyka coefficient (see 3.152) gives a measure of the similarities and differences in the cover of species present in the two plant communities being compared. Results are shown in Table 6 and graphed in comparison with outside values in Figure 8.

Table 6 Adjusted Motyka Coefficient Results

1.85 c28a v. b*	1.66 c17 v. c22*	1.64 c8 v. c9*
1.52 c20 v. c25*	1.44 c3 v. c50	1.32 c35a v. c37a
1.12 c4 v. c6	1.07 c5 v. c28a	1.04 c42 v. c20
1.02 c3 v. c17*	1.0 c23 v. c29a	0.87 c50 v. c46
0.87 c28a v. c49	0.86 c17 v. c46	0.80 c51 v. c11
0.79 c28a v. c30*	0.78 c4 v. c5*	0.76 c16a v. c20
0.75 c23 v. c16a	0.74 c31a v. b	0.73 c28a v. c29a
0.71 c51 v. c48	0.68 c48 v. c36*	0.66 c13 v. c29a
0.64 c4 v. c29a	0.62 c37a v. b*	0.61 c35a v. 37b*
0.61 c13 v. c20	0.60 c52 v. c11*	0.60 c6 v. c47
0.59 c28a v. c41	0.59 c37a v. c36	0.58 c26 v. c20*
0.57 c23 v. c28a	0.57 c47 v. c14	0.57 c16a v. c47
0.55 c23 v. c26	0.55 c47 v. c20	0.55 c29a v. c31a*
0.53 c2 v. c22	0.51 c2 v. c21	0.49 c42 v. c43
0.49 c13 v. c47	0.48 c28a v. c31a	0.48 c28b v. c43
0.47 c51 v. c36	0.46 c26 v. c47	0.44 c23 v. c22
0.43 c16a v. c26*	0.42 c45 v. c11	0.40 c37a v. c35b*
0.39 c28a v. c43	0.38 c26 v. c21	0.37 c5 v. c6*
0.36 c23 v. c47	0.36 c13 v. c31a	0.33 c15 v. c10*
0.30 c47 v. c28a	0.29 c20 v. c27	0.29 c45 v. c51
0.29 c29a v. c14	0.27 c13 v. c14*	0.27 c20 v. c43
0.27 c8 v. c10*	0.25 c51 v. c52	0.25 c51 v. c52
0.24 c21 v. c46	0.23 c35a v. b	0.21 c31a v. c14
0.20 c47 v. 43*	0.19 c23 v. 31a*	0.19 c20 v. c14
0.19 c48 v. c37a	0.15 c50 v. c51	0.15 c23 v. c21*
0.10 c15 v. c8	0.10 c51 v. c37a	0.09 c47 v. c21
0.08 c16a v. c21	0 c15 v. c9	

(coefficient values in bold, communities by their alpha-numeric designation, adjacent community pairs from the tables with an asterisk*)

A total of eighty (80) comparisons were completed for the forty-three (43) plant communities or subcommunities. The higher the value, the more similar the two communities. There was a wide a range in values, from 0 (c5 vs. c9) to 1.85 (28a vs. b.). The values with an asterisk* from adjacent units in the plant community tables (Appendix 8) cover approximately the same range (0.15 to 1.85), with no particular concentrations. Some of the highest values came from comparisons of subcommunities. The use of the adjusted Motyka coefficient led to a number of changes in the subjective classification. Several communities were reassigned as

subcommunities. However, the index was used as a classification aid, rather than as a means of precisely determining the placement of communities. For example, Oak-Broom- *Poa pratensis* (c4) and Oak- Broom- *Elymus glaucus* (c6) had a high similarity (index value: 1.12), but were retained as communities for several reasons. I wanted to differentiate the lesser-disturbed, native *Elymus glaucus* type from the introduced *Poa pratensis* type. The high index value is also thought to represent the "swamping" effect of high broom cover. The two communities, Oak- *Bromus sterilis* (c23) and Oak- *Poa pratensis* (c29a) had a relatively high degree of similarity (index value 1.0), but were kept separate in recognition of their different environmental relationships. These two communities are also discussed as a benchmark comparison in Appendix 12. Some existing subcommunities have a lower index value, but their level of classification was maintained because of visually obvious named species and the simplicity of keeping them as subcommunities.

As benchmarks from the adjusted Motyka comparison are useful as reference points for considering the method and the range of values, two comparisons are presented in Appendix 12 as reference points. One of these comparisons is for "equal similarities and differences" (index value of 1.0) and the other is for the "average" comparison (index value of 0.57).

4.131 Comparisons of Plant Communities from Other Sources

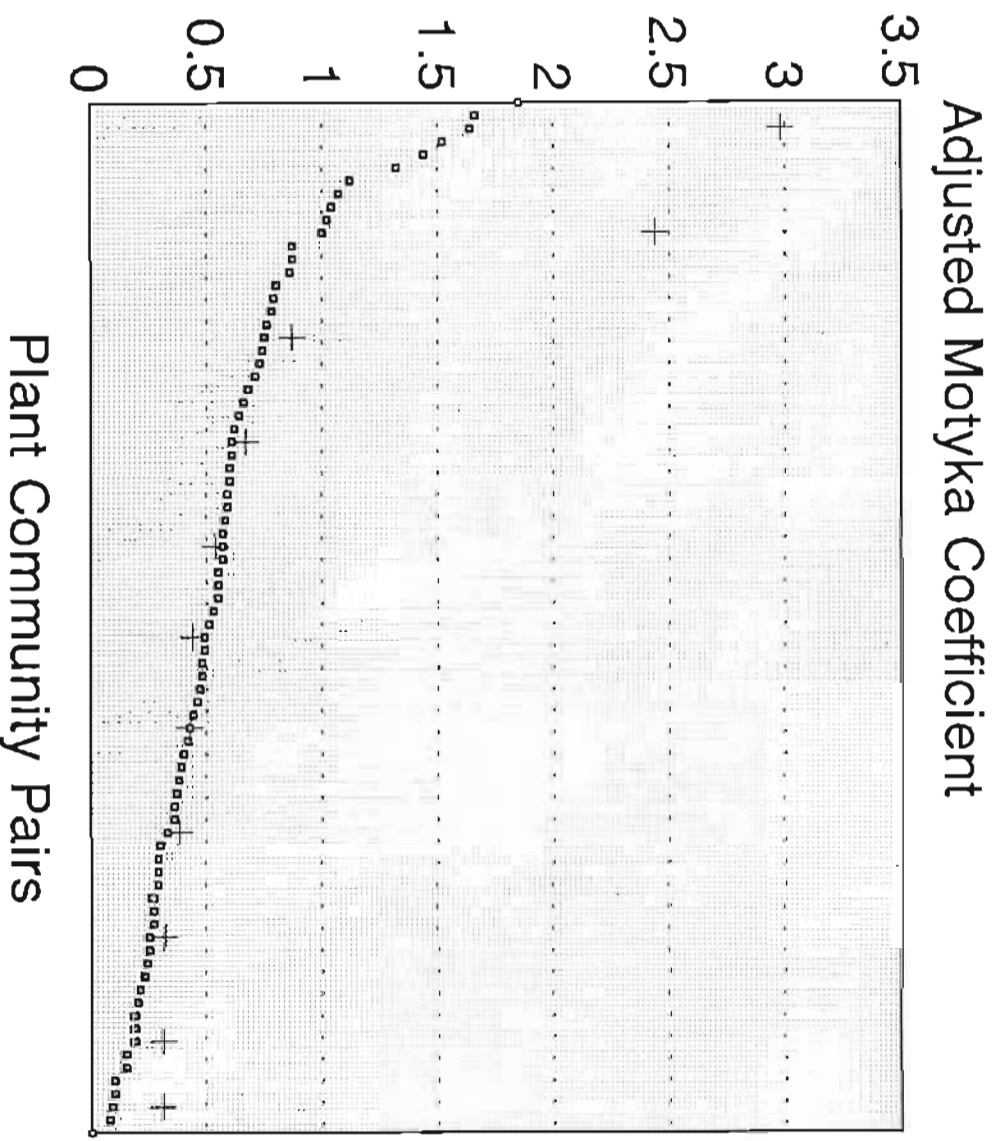
The adjusted Motyka coefficient was used to compare 26 plant communities or other units from oak woodlands, savannah and grasslands (see 3.152) in the Pacific Northwest (Figure 8, Appendix 13). These comparisons provide a means of evaluating the level of differentiation in my classification compared to that of the other studies. The values from adjacent communities in my data (0.15 to 1.85) fall partly within the range (0.31 to 2.98) from the outside data sources, as shown in Figure 8. My study had an average comparison value (0.57) close to the median value (0.64 or 0.54) from the outside comparisons and had index values representing a degree of differentiation most similar to other oak woodland studies. These results

Figure 8. Adjusted Motyka Coefficient Results, including Other Studies

My Plant Community Comparisons with other comparisons from the Pacific Northwest

29

largest values are highest in similarity (file=adjmoty2.ch3)



place my study in a context of scientific classification work. On the other hand, a few of my communities were more similar to each other (high index value) than are the other oak woodland communities to each other, a degree of similarity which does not, however, approach that suggested for the biogeoclimatic ecosystem classification (*BEC*) system of the British Columbia Ministry of Forests in which community pairs are much more similar to each other (four values of 2.44 to 22.1). Nevertheless, two *BEC* units had a degree of differentiation (0.43, 0.54) closer to my communities.

In summary, my level of differentiation was similar to that of other studies in the Pacific Northwest. This similarity represents a relatively consistent level of classification, both within my classification and within the group of studies as a whole. The exception is the minute level of differentiation in the presence-oriented *BEC* classification.

4.14 TWINSPAN Classification (see 3.153)

The purpose of this small subproject was to use the *TWINSPAN* (Two-Way Indicator Species Analysis, Hill, 1979) program to develop an automated classification of my vegetation data, assess this "objective" classification, compare it with my "subjective" classification and examine its hierarchical structure. The *TWINSPAN* classification was completed from the 1993 data, consisting of approximately 150 plots, and compared with the preliminary subjective classification developed from the same plots. Criteria were the same as in the final subjective classification (see 3.15).

TWINSPAN did not meet the review objectives (3.153) and did not contribute to the final classification. In my assessment (Erickson, 1994a) the automated classification was not satisfactory for either hierarchy or objectivity. The program itself was not objective because a) repeated dichotomization always forms an even number of groups, an unusual source of bias; b) it lacks a reliability statistic, such as classification rate and c) the resulting violation of statistical principles such as adequacy of subject-to-variable ratio. Adherence to a subject-to-variable ratio of 10:1

(20:1 for a split-half analysis) would limit the plant species entered to about 15 in my test example. Conversely, reliable statistics from the species and pseudospecies (cover levels) entered in the test would require thousands of plots (subjects).

My second review of objectivity was the use of *TWINSPAN* in the literature and the program did not meet the criteria. Researchers were able to exert a high level of control on the results by selecting species cutoff levels, pseudospecies (cover) levels, portions of the hierarchy to ignore and results to discard for whole sections of the output. These anomalies were found in all studies, including the example introducing the program (Hill, 1979). One of the precepts for the review was that the *TWINSPAN* classification might confirm the subjective classification. In relating to this possibility it is interesting to note how different Hill's (1979) *TWINSPAN* result was from the tabular comparison of Mueller-Dombois and Ellenberg (1974) for their meadow data.

There was no correspondence in the overall structure of the *TWINSPAN* classification compared with my classification. Species from the two main divisions of the *TWINSPAN* classification were distributed relatively evenly across the vegetation gradient in my subjective classification. The hierarchical structure in my *TWINSPAN* run was too complex to be useful, a complexity which would be reduced only at the further expense of objectivity. The two classifications differed in the number of groups formed. The *TWINSPAN* analysis resulted in the formation of substantially more groups (64) on 6 levels, dichotomized into 2 major trees (see Appendix 14). The subjective classification had 32 groups, unequally distributed on 2 levels.

There was little agreement between the two classifications in the use of indicator species. There were more indicators (32) unique to the *TWINSPAN* classification than shared between the two classifications (26). *TWINSPAN* responds to small amounts of cover, with the result that extensive use is made of minor species considered unimportant in my subjective classification. Emphasizing native species is essential for preservation status assessment and conservation biology objectives

(e.g. Salwasser, 1993; British Columbia Ministry of Forests, 1995). The higher ratio of native/introduced indicator species gives a slight advantage to the subjective classification by featuring native species, with 78.5% of the total, compared with 73.1% for *TWINSPAN*. The lower value of the *TWINSPAN* result reflects the use of 21 introduced species compared with 14 for the subjective classification.

4.15 Multiple Regression Results (see 3.16)

A series of exploratory multiple regression analyses was completed on the 1993 data using *SPSS for WINDOWS (VERSION 6.0)*. The purpose was to examine the relationships between the plant communities and environmental variables, by determining which of the following account for the variation in the plant community gradient (the dependent variable): surface rocks, surface shape, aspect, elevation, bedrock and humus over bedrock, slope, and ecological moisture regime (the independent variables). Ecological moisture regime was also run as a dependent variable with the remaining six environmental variables. The sample domain was restricted to the actual confines of the plots sampled.

A general multiple regression is employed to determine whether there is a relationship between all the independent variables taken together (the predictors) and the dependent variable (criterion) based on the proportion of variance accounted for. The "Adjusted R-square" is the statistic used for interpretation of this proportion because it gives the reliable result reflecting shrinkage from the R-square to remove positive bias, to compensate for smaller sample sizes and for lower subject-to-variable ratios. In a general multiple regression (using default settings) the "Adjusted R-square" for all the predictors was 0.407, or 41% of the variation in the plant community gradient. Little shrinkage (<0.04) occurred in the "Adjusted R-square" because the subject to variable ratio was kept higher (18:1) than the level at which shrinkage becomes a concern (10:1). "Beta" or standardized beta weights are used to interpret which variables have the highest relative value in the prediction equation, with all other variables taken into account. The full equation is not of interest here because the "raw scores" ("beta") form is only used to reinterpret

individual test results. Moisture regime had the highest "Beta" weight: -0.54 with all other predictors taken into account. The only other predictor with a "Beta" weight above .1 (positive or negative) was elevation: -.23 with all the other predictors taken into account. The standardized formula showing these "Beta" results is:

$$\hat{y} = .540103 \times F + .236909 \times B + .099341 \times E + .060171 \times H \\ + .041312 \times D + .007835 \times G + -.049472 \times C + .074105 \text{ (error);}$$

where: F= moisture regime, B= elevation, E= surface shape, H= rocks, D= aspect, G= bedrock and humus over bedrock, and C= slope.

Correlation methods are used, interpreted with r-square values, to determine which variable is the most important by itself in accounting for variation in the criterion. A Pearson-product-moment correlation examined the individual relationships between and among the predictors and the plant community gradient. Moisture regime had the highest correlation with the gradient, with an r-square of 0.37, representing 37% of the variation. Percent bedrock and humus over bedrock accounted for 15.2% of variation. Surface shape and percent slope accounted for 13.8% of variation each, followed by aspect, elevation, and percent surface rocks, with 6%, 7.6%, and 3.5%. The correlation also served to examine the small contribution made in the general multiple regression by seemingly important predictors. Moisture regime is a composite variable, which includes the influence of all the other variables, as well as a number of others not included or not measured. The following were correlated strongly (collinear) with moisture regime: percent surface bedrock and humus over bedrock, 42.2% of variation; surface shape, 32.9% of variation; and percent slope, 27% of variation. Less correlated were aspect, 5.6%; elevation, 5%; and percent rock cover, 2.4%. In a general multiple regression with ecological moisture regime as the dependent variable, the six other environmental variables resulted in a very high "Adjusted R-square" of 0.58, with minimal shrinkage (.019).

Stepwise multiple regression was applied to examine the influence of predictor variables on the plant community gradient taken first separately (step one) then with the previously entered variables taken into account (subsequent steps). In a stepwise

multiple regression with all the variables, only two steps were required before no new variation was accounted for (using the SPSS default parameters). With just these two steps an "Adjusted R-square" of 0.43 was obtained. Shrinkage in the "Adjusted R-square" was very low (<0.009), with the higher subject-to-variable ratio resulting from the use of only two steps. Interpretation of the influence of the variables uses "percentage of variation accounted for", which is derived from the individual R-square values. The prediction equation is not relevant to interpretation. Step one was moisture regime, accounting for 37% of the variation in the plant community gradient, as in the correlation result. Step two was for elevation, which contributed an additional 5.5% of variation.

Moisture regime was excluded in a subsequent stepwise multiple regression to investigate the influence of the other predictors separately. Four variables were entered under the SPSS defaults. Without moisture regime, values were considerably lower, but still substantial, with an "Adjusted R-square" of .316. Shrinkage was low (<0.03) with the high subject-to-variable ratio. Percent bedrock and humus over bedrock account for the most variation: 15.5%. Aspect accounted for 5% of variation; surface shape for 3.1%; and elevation for less than 1%. Percent slope and percent surface rocks were not entered into the regression by the program defaults. At this point the addition of these last two variables was not necessary as virtually all of the variation was accounted for.

The multiple regression and correlation results suggest definite relationships which support the subjective premises of the project: that plant communities relate to environmental factors and that ecological moisture regime is the primary factor. However, this analytical work was not the main focus of the ecosystems part of the thesis. Subjectively derived information on the landscape relationships, ecological moisture regime and geographic areas of the plant communities are given in Chapter 5 and 6. The key environmental factors from these analytical results, such as ecological moisture regime and elevation, are given separate recognition within plant communities, presented on charts or noted where they seemed to be the factors distinguishing individual plant communities.

4.2 CLIMATE IN THE STUDY YEARS

I characterized the climate of the study years and compared the years with each other and with Atmospheric Environment Service (AES) normals for the Victoria Airport (Environment Canada, 1991, 1992, 1993). Comparing the years and normals examined the possibility that yearly climate was atypical to an extent causing abnormal vegetation. Though the outcome did not suggest abnormal variation, the results are given as a reference point for comparison with other ecological studies. The details of the yearly climate and the year-to-year comparison are given in Appendix 15, including Figures 29-33.

The year-by-year climate did not fall within the normals for all years. However, values varied both above and below for most categories, suggesting averages for the study period similar to the long-term normals. Standard deviations were not available. The variations did not seem enough to make a difference in vegetation away from that of average years or cycles. Many of the dominant plants of the communities are perennials, which should be resistant to adverse variations. Plant phenology may have been affected, although a two to three week variation is often taken for granted. The shortfall in winter precipitation may have affected only surplus soil moisture, not storage/recharge. The March to September precipitation pattern was probably not far off normal, with slightly more months (3) with generally higher precipitation over the four years. Monthly mean temperatures were generally higher than the normals. Sunshine hours were generally equal to normal across the four years.

4.3 REGENERATION OF OAK

Natural regeneration of oak was compared using the seedling and sapling designations described in 5.11 for all native plant communities and all first and second-order plant communities (Figure 9). Regeneration is the ability to successfully recruit seedling and shrub layer oaks. There has been a great deal of concern expressed in the literature about lack of oak regeneration (Tunison, 1973; Pojar, 1980b; Gordon et al., 1989; Keeler-Wolfe, 1990; Kavanaugh, n.d.; Hibbs and Yoder,

1993). Rossi (1980, p.8) called " the conspicuous lack of oak regeneration" "perhaps the most important issue in oak management." There were three transects without any saplings (<1 m) in the regeneration study of Corrigan (1991) for the Victoria area.

Competition from introduced plant species, broom and native shrubs is considered to be an important factor responsible for this shortcoming (e.g. Reed and Sugihara, 1987; Welker and Menke, 1990; Hibbs and Yoder, 1993; Kavanaugh, 1992a, n.d.). Therefore, I expected to confirm these relationships with plot data comparisons between native and introduced plant community categories. Contrary to these expectations, there was not much difference in these and other categories, except for:

- a slightly higher percentage of native plant communities with saplings present on all sites and a slightly higher percentage which are well-stocked compared with "disturbed" (first- and second- order) communities
- slightly more plant communities with sapling regeneration on all sites from the other native plant communities compared with the early-season plant communities
- a higher percentage of plant communities with sapling and seedling regeneration present on all sites on the second-order category (broom) communities than the first-order disturbance category and a higher percentage with moderate to well-stocked saplings
- a higher percentage of plant communities with light stocking for both the sapling and seedling classes on the first-order disturbance category than the second-order disturbance (broom) category
- a slightly higher percentage with saplings present on most sites and seedling regeneration present on all sites for the second-order disturbance categories compared with other native plant communities
- a higher percentage with well-stocked saplings for other native plant communities compared with second-order disturbance communities

The first-year results of Krannitz and Bennett (1994) for one site on Vancouver Island (Mary Hill) correspond in general to my results. These authors suggested that

grass and shrub competition did not affect oak survival. The regeneration results from Corrigan (1991) for the Victoria area exceeded those in the recruitment model of Anderson and Pasquinelli (1984) for *Quercus garryana* in northern California.

My comparisons raise questions regarding the suggested inadequacy of oak regeneration and the role of competition from introduced species and native shrubs. Although this competition is hypothesized to be an ecosystem dynamic, regeneration of oaks in the native plant community category was not better than that of the introduced community category. Similarly, regeneration was apparently not inhibited by native shrub plant communities. It seems possible that the comment of Bartolome et al. (1987) may also apply to the study area, that overgeneralization of the actual status of oak regeneration is the common thread that binds together the concerns expressed.

More detail on a more precise scale for evaluation is provided in the plant community descriptions. When considered on a community-by-community basis there were 11 plant communities in which regeneration was limited in some way, either absent or present only on some sites or with stocking below normal. These communities were split about evenly between introduced and native communities and between "xeric" and "mesic", but were predominantly "grassy". Grass competition with oak species has been demonstrated in California, where competition inhibited growth and this was thought to lead to decreased seedling survival (Danielsen and Halvorson, 1991). Further investigation at an appropriate scale might reveal a similar situation in British Columbia.

FIGURE 9. REGENERATION SUMMARY OF GROUPING CATEGORIES FOR PLANT COMMUNITIES

GROUPING	SAPPLINGS			REGENERATION			SEEDLINGS			STOCKING			SEEDLINGS											
	SOME	MOST	ALL	ABS.	SOME	MOST	ALL	LT	L-M	L-MW	M	MW	M-W	W	VW	NON	V LT	LT	L-M	L-MW	MD	MW	MW-W	W
ALL: #	6	30	7	1	9	24	9	5	3	2	12	13	6	4	1	1	2	23	6	3	2	4	1	1
%	14	70	16	2	21	56	21	12	7	5	28	30	14	9	2	2	5	53	14	7	5	9	2	2
NATIVE: #	5	16	5	1	5	15	5	2	1	2	6	9	4	4	1	1	1	15	3	3	0	1	1	1
%	19	61	19	4	19	58	19	8	4	8	23	35	15	15	4	4	4	58	11	11	0	4	4	4
DISTURBED: #	1	14	2	0	4	9	4	3	2	0	6	4	2	0	0	0	1	8	3	0	2	3	0	0
%	6	82	12	0	23	53	23	18	12	0	35	23	12	0	0	0	6	47	18	0	12	18	0	0
NATIVE E: #	1	6	0	1	1	3	2	1	0	2	0	3	1	0	0	1	0	5	0	0	0	1	0	0
%	14	86	0	14	14	43	28	14	0	28	0	43	14	0	0	14	0	71	0	0	0	14	0	0
NATIVE O: #	4	11	5	0	4	12	4	1	1	0	5	5	3	4	1	0	1	11	3	3	0	2	1	0
%	20	55	25	0	20	60	20	5	5	0	40	40	15	20	5	0	5	55	15	15	0	10	5	0
1ST ORDER: #	1	8	0	0	3	6	0	3	2	0	3	3	0	0	0	0	0	5	2	0	0	2	0	0
%	11	89	0	0	33	66	0	33	22	0	33	33	0	0	0	0	0	55	44	0	0	22	0	0
2ND ORDER: #	0	6	2	0	1	3	4	0	0	0	5	1	2	0	0	0	1	3	1	0	2	1	0	0
%	0	75	25	0	12	37	50	0	0	0	62	12	25	0	0	0	12	37	12	0	25	12	0	0
NATIVE O: %	20	55	25	0	20	60	20	5	5	0	40	40	15	20	5	0	5	55	15	15	0	10	5	0
2ND ORDER: %	0	75	25	0	12	37	50	0	0	0	62	12	25	0	0	0	12	37	12	0	25	12	0	0

NOTES: number (#) or percentage (%) of plant communities within each grouping per category.
 Sec 5.11 for the categories. Regeneration on some, most or all sites. Stocking as Light, Modernic, or Well, with qualifiers and intergrades.
 The categories Saplings Absent and Non-stocked were not needed.
 The groupings were abbreviated as follows: All = All the plant communities; Native E = Early season native plant communities; Native O = Other native plant communities;
 Native = both the previous; 1st Order = First Order Disturbance plant communities; 2nd Order = Second Order Disturbance communities;
 Disturbed = both the previous together.

CHAPTER 5 PLANT COMMUNITIES AND ECOSYSTEMS (1): NATIVE PLANT COMMUNITIES

5.0 INTRODUCTION (see also 4.1)

The next two chapters follow from the overview in Chapter 4, by describing the plant communities, the focus of this study, discussing and interpreting them. Native plant communities (named for native plant species) are covered in this chapter, introduced plant communities (named for introduced plant species), corresponding to the first-order and second-order disturbance communities, in the following chapter. The terms "first-order" and "second-order" disturbance communities reflect the apparent sequence of vegetation change and site disturbance following the introduction of non-indigenous species by European colonists (see 2.5). The plant community interpretations are intended to be used within the context of the management strategy in Chapter 7. Generalized relationships of the native plant communities to the landscape (but not necessarily to each other) are illustrated in Figures 10 to 13. Based on the multiple regression results and my extrapolations, a summary of the placement of the native plant communities by ecological moisture regime and geographic area is provided in Figures 14 to 19. This summary both supplements the ecosystem descriptions which follow and illustrates the separation or overlap in these factors.

5.1 DESCRIPTIVE CATEGORIES The plant communities which follow (see 5.2) consist of three major categories, an ecosystem description, discussion and interpretations. These categories are explained in the following section unless otherwise dealt with in the methods chapter (3). I used both the scientific and common names in order to make the content available to a wide range of audiences. I have particularly used common names for three very familiar and easily identifiable species: oak (Qg in tree symbol) (*Quercus garryana*), Douglas-fir (Fd in tree symbol) (*Pseudotsuga menziesii*) and broom (*Cytisus scoparius*). Non-indigenous species have the term "introduced" added to their common names to clearly differentiate them from native species.

FIGURE 10 LANDSCAPE DIAGRAM FOR EARLY SEASON PLANT COMMUNITIES

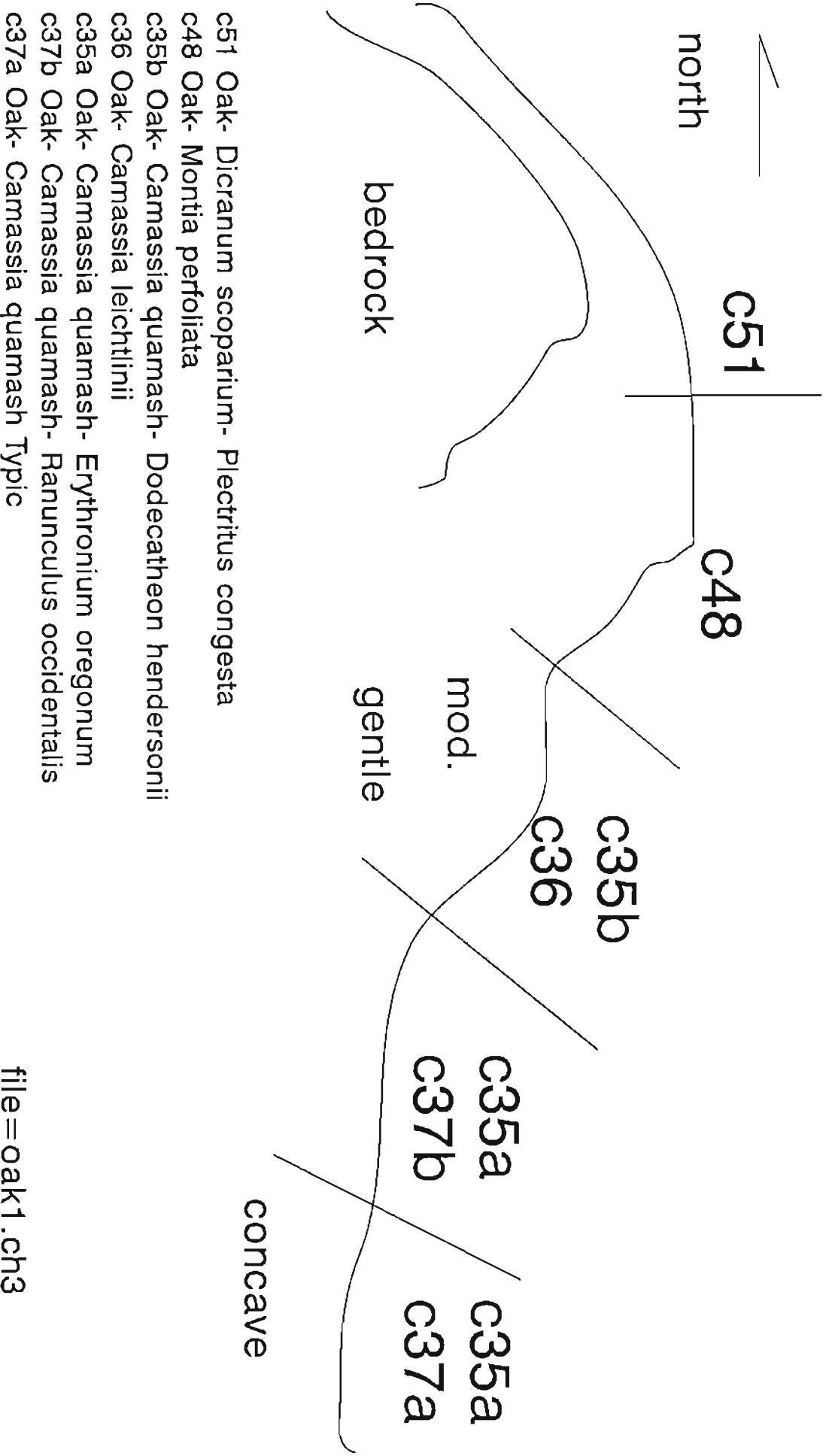
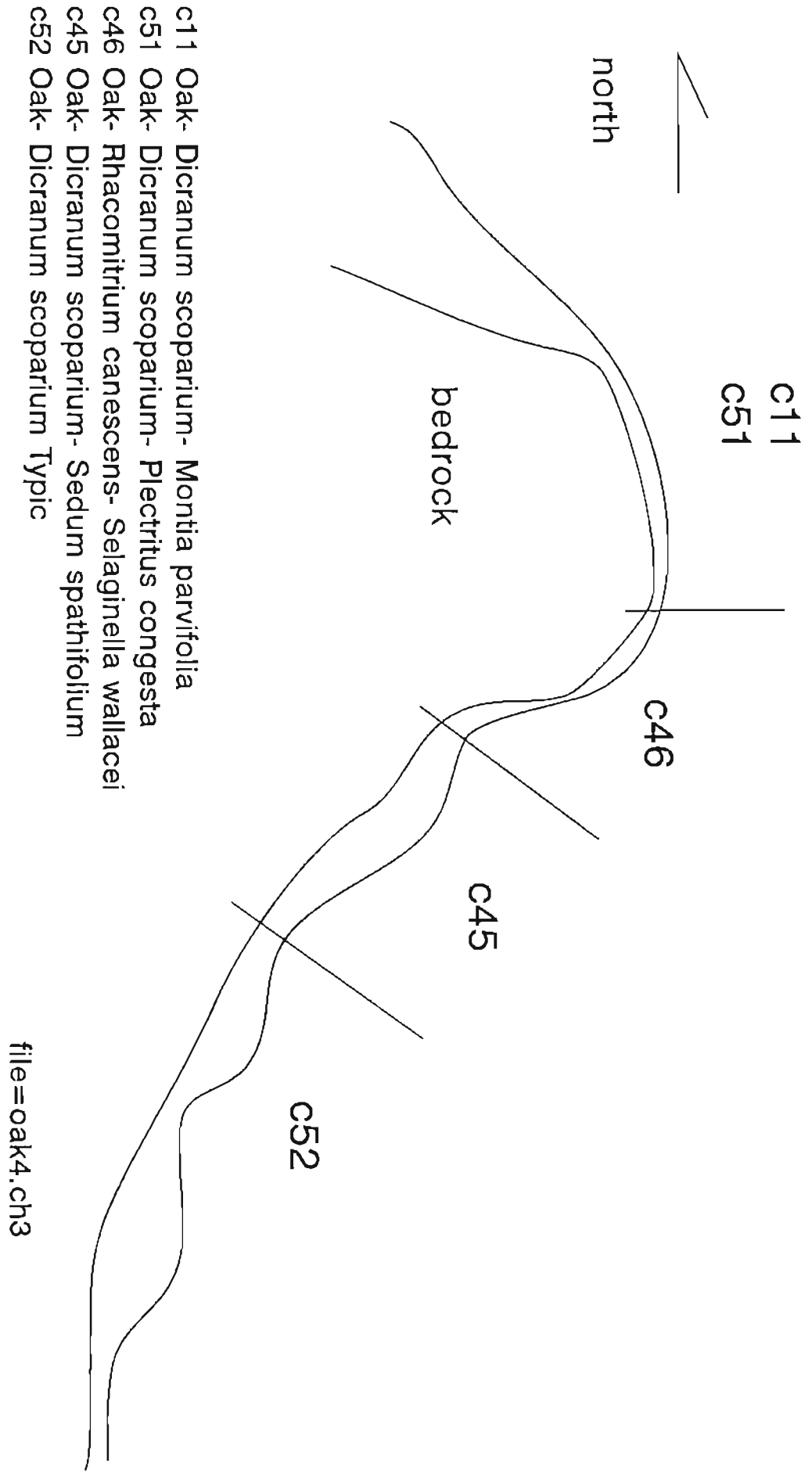


FIGURE 11. LANDSCAPE DIAGRAM FOR NATIVE BEDROCK PLANT COMMUNITIES



75 **FIGURE 12. LANDSCAPE DIAGRAM FOR OTHER NATIVE PLANT COMMUNITIES (1)**

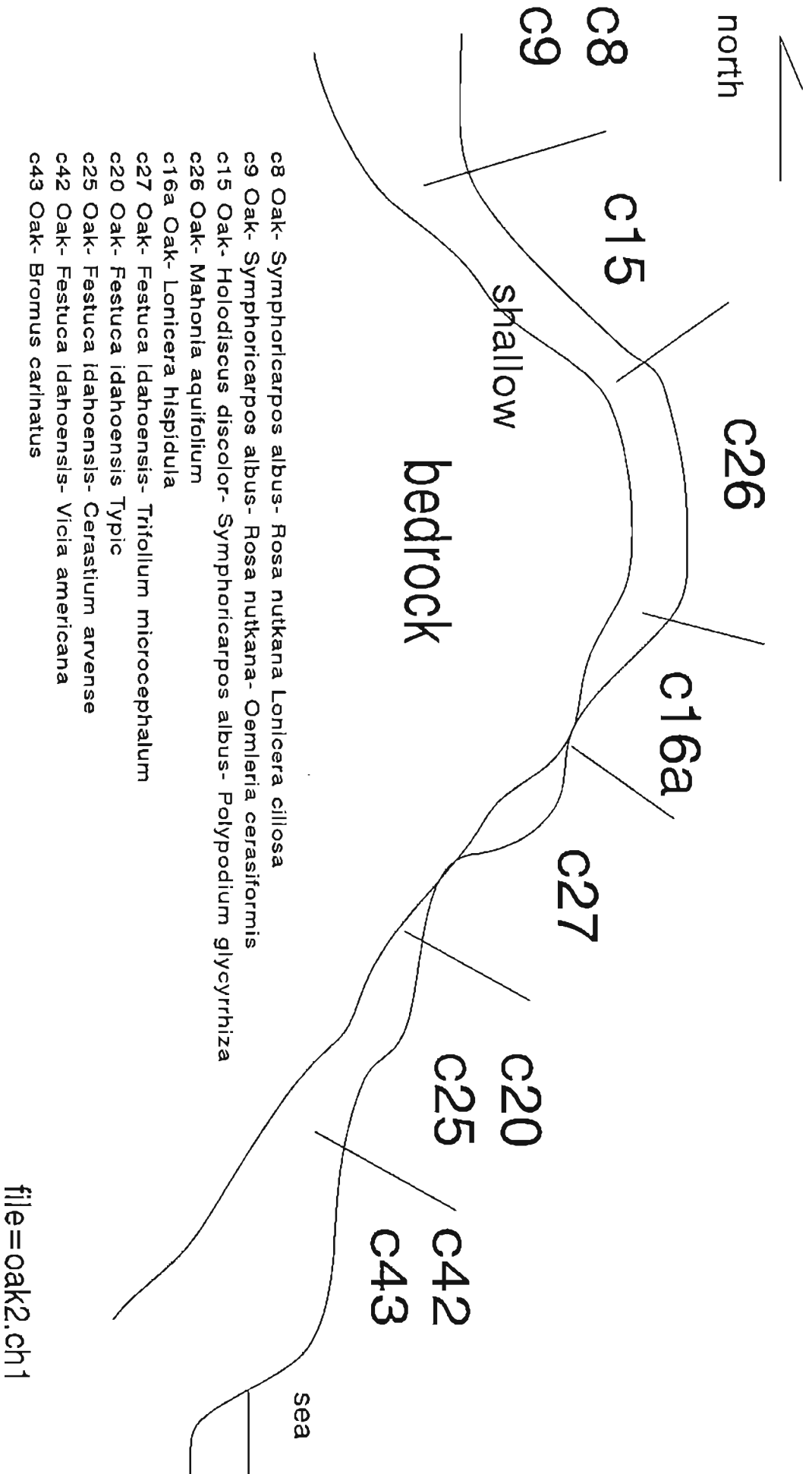
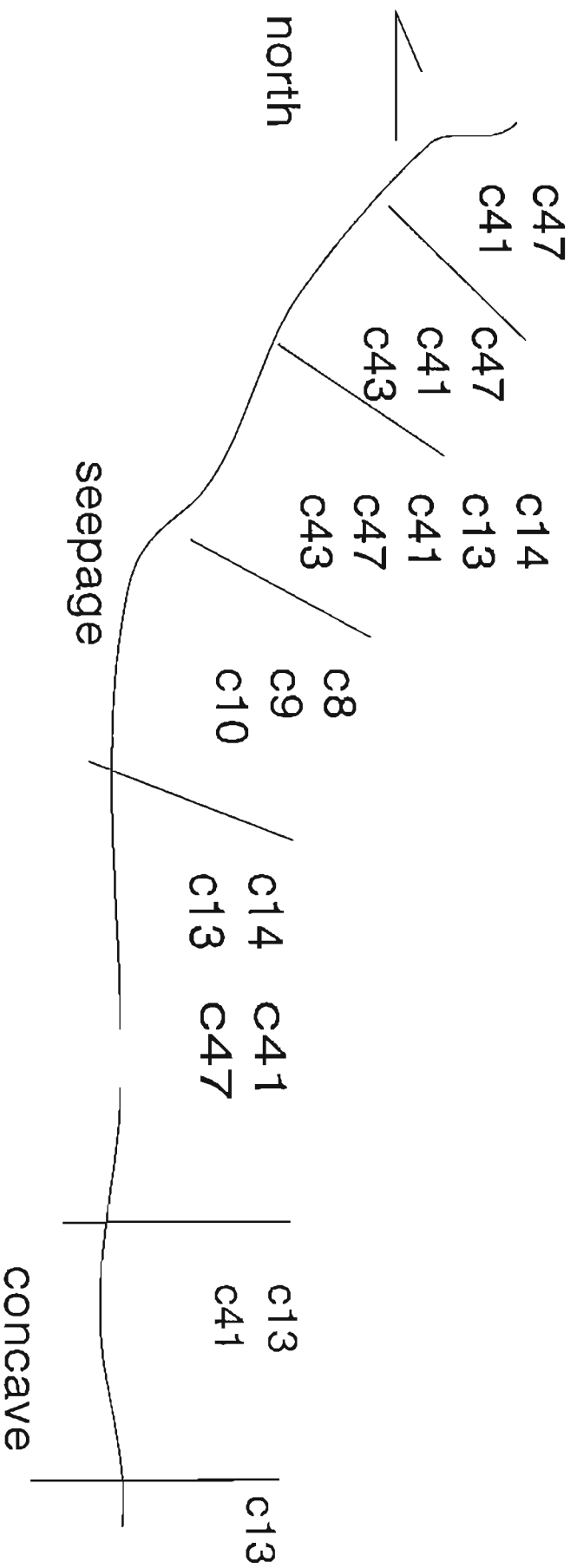


FIGURE 13. LANDSCAPE DIAGRAM FOR OTHER NATIVE PLANT COMMUNITIES (2)



c47 Oak- *Elymus glaucus*

c41 Oak- *Lathyrus nevadensis*

c43 Oak- *Bromus carinatus*

c8 Oak- *Symphoricarpos albus*- *Rosa nutkana*- *Lonicera ciliosa*

c9 Oak- *Symphoricarpos albus*- *Rosa nutkana*- *Oemleria cerasiformis*

c10 Oak- *Holodiscus discolor*- *Symphoricarpos albus*- *Rhytidadelphus triquetris*

c14 Oak- *Carex inops*

c13 Oak- *Melica subulata*

file=oak3.ch3

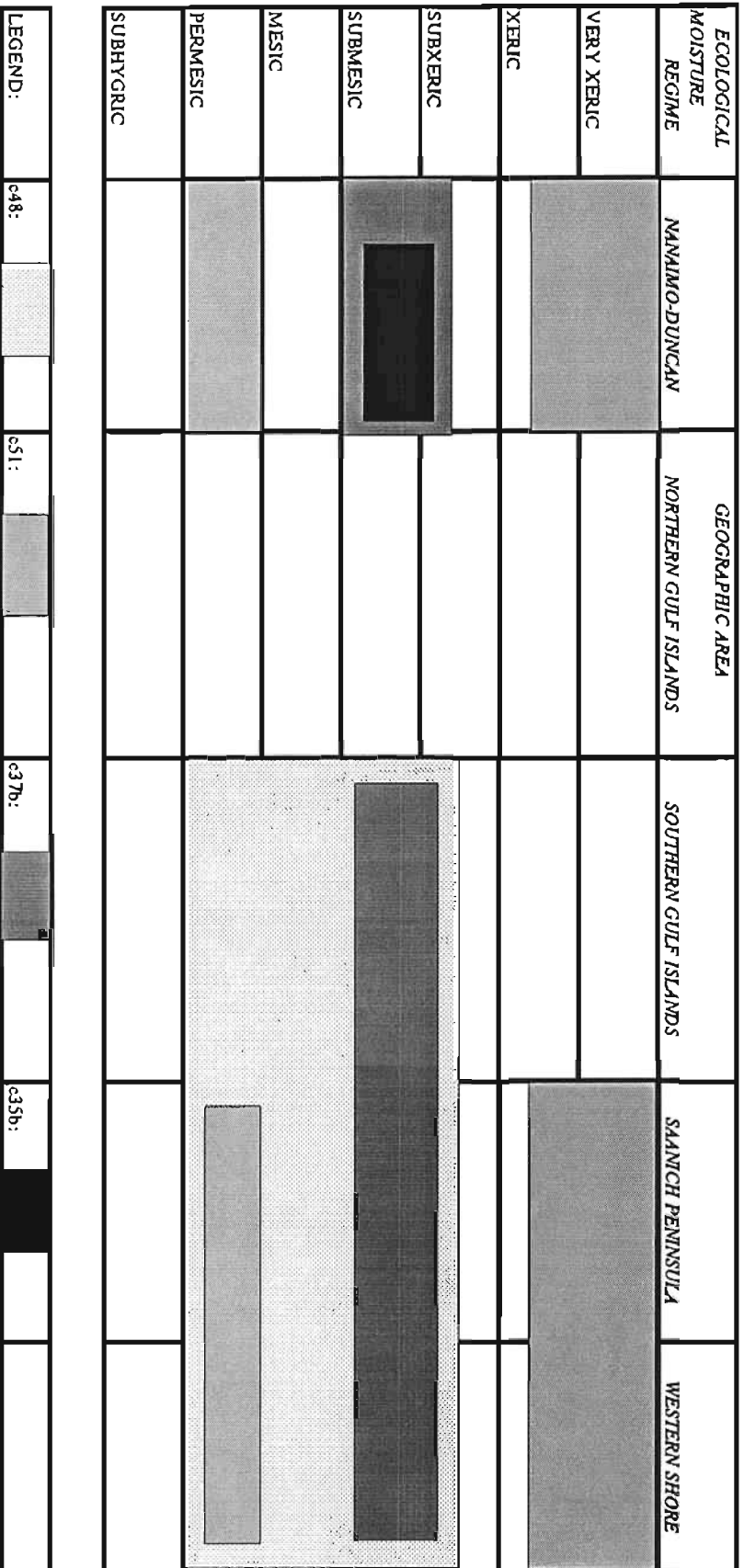
FIGURE 14. DISTRIBUTION AND MOISTURE REGIME OF EARLY SEASON PLANT COMMUNITIES (1)

ECOLOGICAL MOISTURE REGIME	MANALMO-DUNCAN	GEOGRAPHIC AREA NORTHERN GULF ISLANDS	SOUTHERN GULF ISLANDS	SALANCH PENINSULA	WESTERN SHORE
VERY XERIC					
XERIC					
SUBXERIC					
SUBMESIC					
MESIC					
PERMESIC					
SUBHYGRIC					

LEGEND:	α36:	α35b:	α37a:	α35a:
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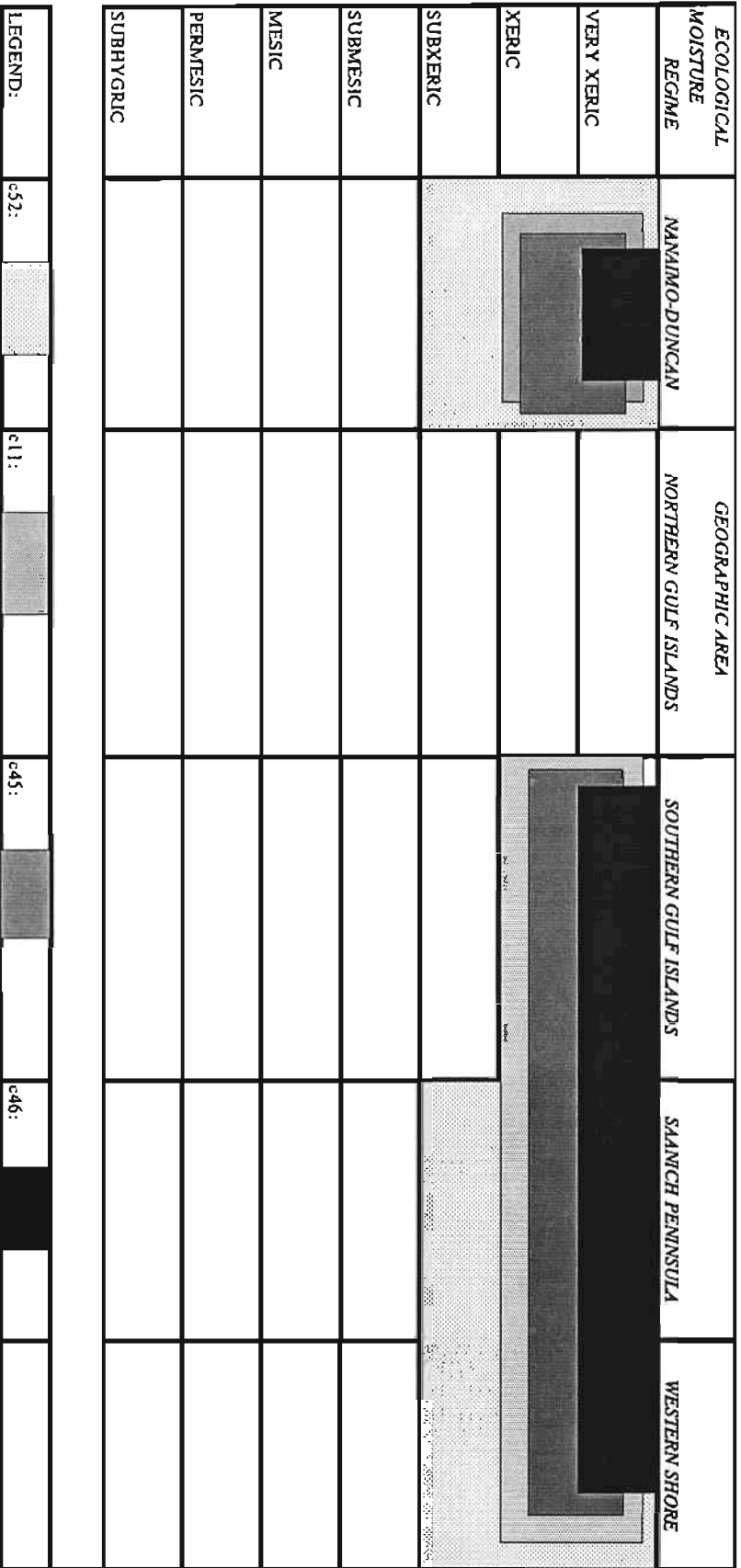
Plant communities are given by their alpha-numeric designation. See Figure 4 for the names and 5.11 for the geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

FIGURE 15. DISTRIBUTION AND MOISTURE REGIME OF EARLY SEASON PLANT COMMUNITIES (2)



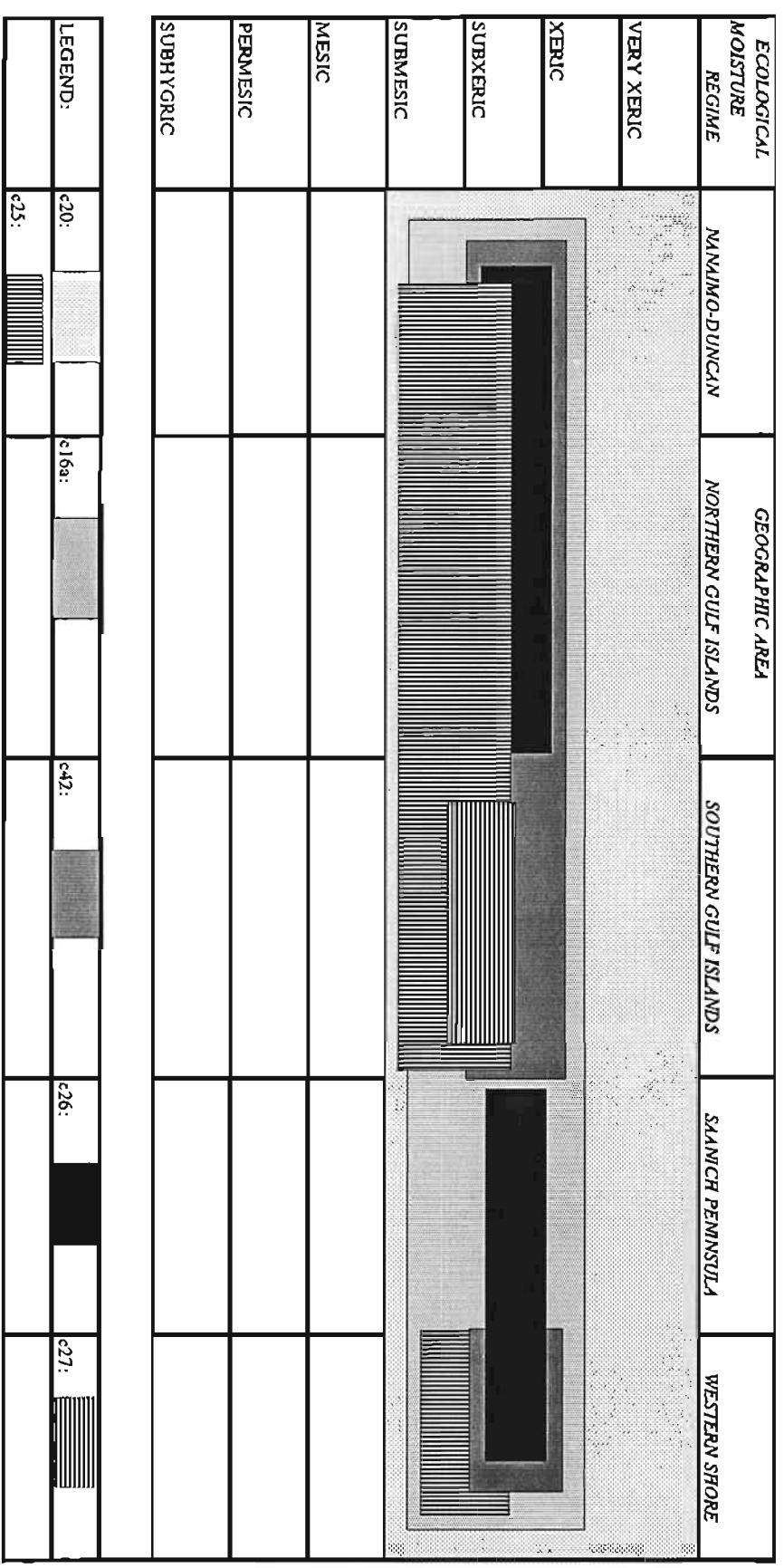
Plant communities are given by their alpha-numerical designation. See Figure 4 for the names and 5.11 for geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

FIGURE 16. DISTRIBUTION AND MOISTURE REGIME OF NATIVE PLANT COMMUNITIES OF BEDROCK HABITATS (1)



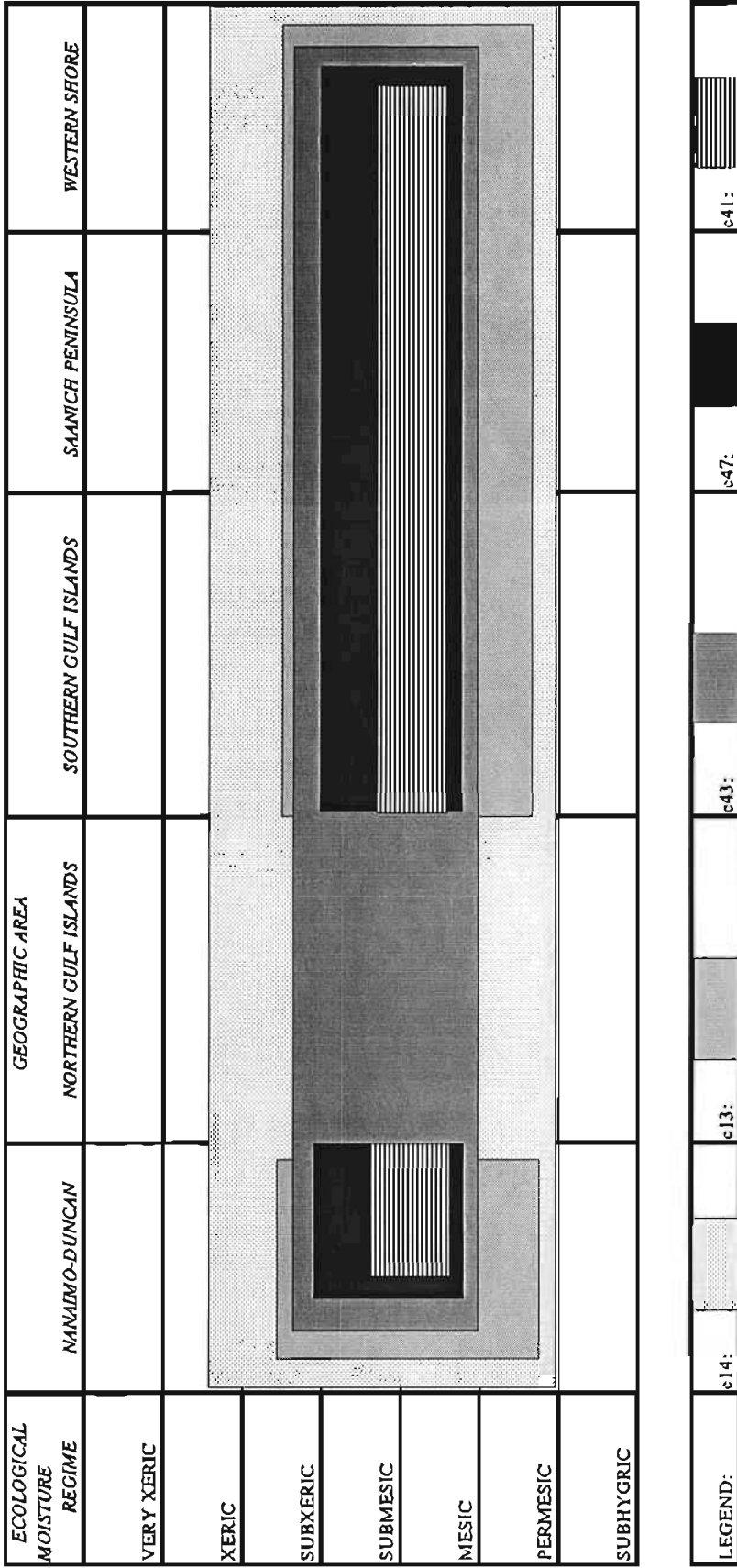
Plant communities are given by their alpha-numeric designation. See Figure 4 for the names and 5.11 for geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

FIGURE 17. DISTRIBUTION AND MOISTURE REGIME OF OTHER NATIVE PLANT COMMUNITIES (1)



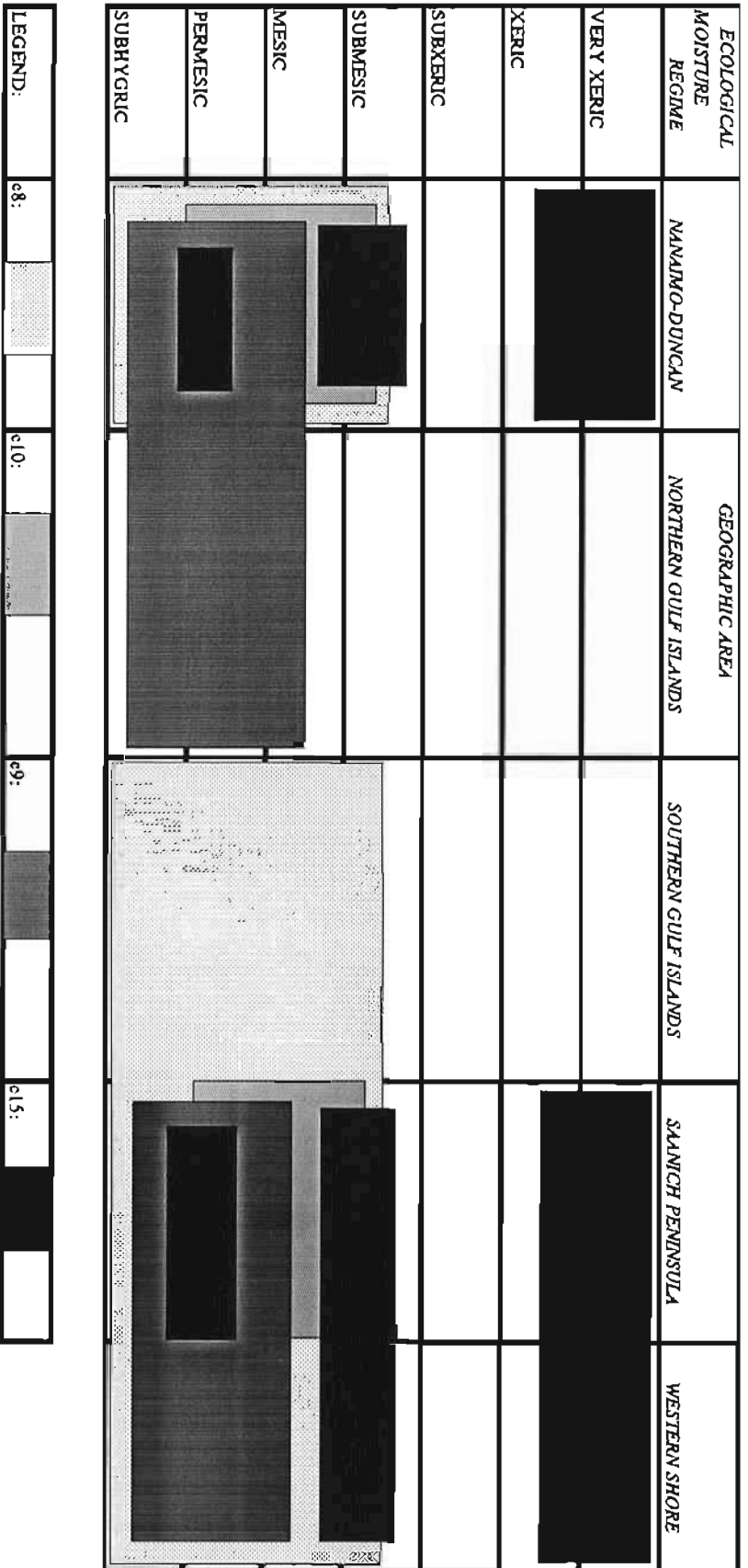
Plant communities are given by their alpha-numeric designation. See Figure 5 for the names and 5.11 for geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

FIGURE 18. DISTRIBUTION AND MOISTURE REGIME OF OTHER NATIVE PLANT COMMUNITIES (2)



Plant communities are given by their alpha-numeric designation. See Figure 5 for the names and 5.11 for geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

FIGURE 19. DISTRIBUTION AND MOISTURE REGIME OF OTHER NATIVE PLANT COMMUNITIES(3)



Plant communities are given by their alpha-numeric designation. See Figure 5 for the names and 5.11 for the geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

5.11 Ecosystem Description Category

Plant Community Descriptions: All species with a mean presence of ≥ 0.70 (≥ 0.67 for 3-plot groups) are included. The average cover of each species is given according to the average of the cover classes, as follows: Class 1: 0 to 1 %, Class 2: 2 to 10%, Class 3: 11 to 25 %, Class 4: 26 to 50 %, Class 5: 51 to 75 %, Class 6: 76 to 100 %. The values in the descriptions are the average class converted back from percent cover data. Two classes together (e.g. "2 to 3") do not express a range, rather the average was close to the mid-point for the two classes. The low shrub layer (B2) is 0.5 to 2 m The tall shrub layer (B1) is 2 to 10m (Walmsley et al., 1980).

Oak Regeneration: All regeneration was apparently natural regeneration. Seedlings and saplings are described separately. I used the low shrub layer, as above, to delineate the 'sapling' class. The tall shrub layer could not be used because it included adult oaks. The statement about the presence of regeneration used the presence class requirement above: all sites-- 1.0; most sites-- < 1.0 but ≥ 0.70 ; some sites-- < 0.70 . I adapted the stocking categories from Bolsinger (1988) to accommodate my field data, as follows: "Nonstocked" -- no seedlings or saplings; "Lightly-stocked" -- averaged cover class 1; "Moderately well-stocked" -- averaged class 2; "Well-stocked" -- averaged class 3 or greater.

Elevation: Elevation was expressed in relative classes within the elevation range of the study area, as follows: low -- 0 to 50 m; medium -- 51 to 99 m; high -- ≥ 100 m. There were a number of sites well up into the high elevation class (up to about 550 m), but the 100 m lower boundary was chosen because it seemed appropriate from my field observations.

Slope: gentle: 0 to 20 %, moderate: 21 to 30 %, moderately steep: 31 to 40 %, steep: 41 to 60 %, very steep ≥ 61 %.

Distribution: Five geographic area categories were used: western shore (west of the Saanich Peninsula, out to East Sooke); Saanich Peninsula; southern Gulf Islands (Saltspring to Galiano and the islands south); northern Gulf Islands (north of this to Denman and Hornby Islands); and Nanaimo-Duncan (north to Nanoose Bay and south to either the Saanich Peninsula or western shore areas).

Diameter Classes: Diameter classes are given for oak (diameter at breast height) as follows: small-- 0 to 29 cm, medium-- 30 to 49 cm, large-- ≥ 50 cm. Diameters were taken at 50 cm on oaks < 2 m tall and at 20 cm on oaks < 0.5 m tall.

Percent Coarse Fragments: These are designated for rock fragments (gravel, cobbles and stones) > 2 mm (Walmsley et al., 1980) within soil, with categories as follows: low: 0 to 40%; medium: 40--70% ; high: $\geq 70\%$.

Physiognomic Type: I developed the 17 physiognomic type classes to relate to the structural form of the stands, vegetation physiognomy, genetic materials and other major features as part of a wildlife habitat classification (Erickson, 1993c). The following classes were subjectively assigned to the plant communities:

Oak - Dense Shrub Cover; Oak - Moderate Shrub Cover - Herb - Parkland; Oak - Light Shrub Cover - Bulb - Parkland; Oak - Grass - Parkland; Oak - Light Shrub Cover - Herb - Rockland; Oak - Fern - Rockland; Oak - Grass - Rockland; Oak - Talus - Sparse Shrub Cover - Herb Parkland; Shrub Oak - Krummholz - Sea-edge; Oak - Woodland; Shrub Oak - Broom - Rockland; Oak - Broom - Parkland; Shrub Oak - Basin - Broomland; Shrub Oak - Basin; Shrub Oak - Rock Outcrop; Shrub Oak - Shrub Thicket and Oak - Shrub Thicket.

These are called physiognomic types because physiognomic attributes are common to each, although other characteristics make a contribution. I reviewed world-level physiognomic classifications, found contradictions such as height vs. cover restrictions, and decided to use the classes of Daubenmire (1968) as my basis (Erickson, 1993a). The following factors were used in developing or refining the major classes: form of oak, vertical vegetation structure by layer, horizontal vegetation structure, major vegetation type, landform genetic material/ surface expression and special situations. The final physiognomic types are not represented in all possible combinations because they did not seem to be expressed that way in the field.

Woodlands have high oak tree layer cover (class 5 or greater) and were of a size which could be mapped (1/2 ha minimum). Smaller than this or with lesser or discontinuous oak cover and the stand was called a parkland. Whereas woodlands

have oak cover as the continuous part of the landscape, parklands have openings as the continuous phase, with oaks in patches (Daubenmire, 1968). The term "parkland" has a history of use in our area (e.g. Roemer, 1972; McMinn et al., 1976). "Shrub oak/ Rock Outcrop" was used for bedrock dominated landscapes with B layer oaks (< 10 m), following historic precedence (McMinn et al., 1976). I am using the term "shrub" to avoid the use of the derogatory term "scrub". It should be noted that shrubby growth forms of oaks are characteristic of habitat where environmental stress is relatively great" (Rundel, 1980, p.52). "Rockland" was a type parallel to shrub oak/rock outcrop, but with tree layer oaks. One type was recognized on stabilized talus and this is reflected in its name. Others such as Beard (1978) have recognized the role of physiographic features such as talus and scree in physiognomic systems.

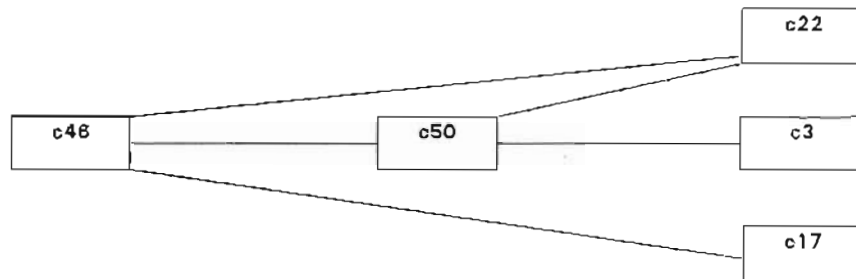
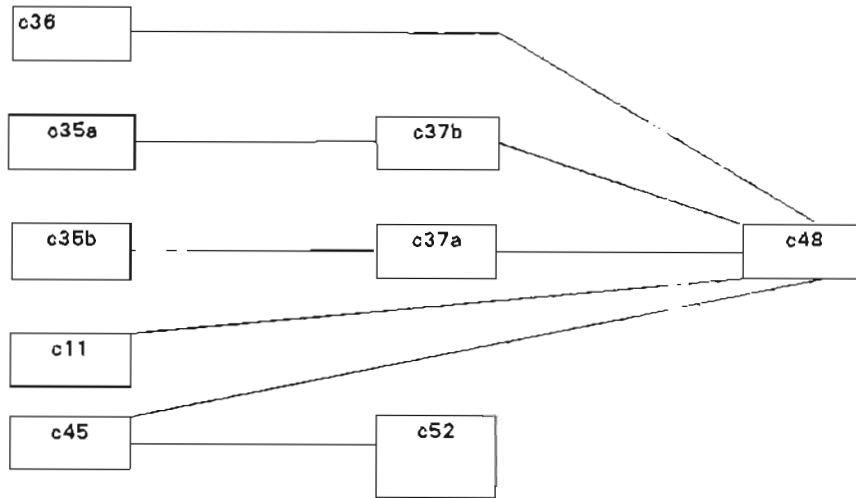
Dominant vegetation layers, growth forms or species are recognized in the names of the types. "Broomland" is used in recognition of the significance of this species (e.g. Zielke et al., 1992) and to relate to all the previous types on the broom dominated landscape. Native shrub cover is specified into classes, including recognition of the thicketed form where heavy cover is the most pronounced, multi-layered and has a distinct edge. I used the term "krumholz" in the name of one class because this term best describes its form of oak, which grades upwards from pencil height to about 2 m with distance away from the wind and sea exposure. This creeping growth habit is consistent with the use of the term in the literature (Franklin and Dyrness, 1973; Mueller-Dombois and Ellenberg, 1974), although it is qualified with and applied to this phenomena at the upper elevation tree line (op.cit.). Kruckeberg (1982) described a shrubby form of oak found on exposed headlands in the San Juan Islands of Washington, which is likely the same as I have labelled "krumholz".

Information on other categories in the descriptions is found in the source materials for the field survey methods (Canada Soil Survey Committee, 1978; Walmsley et al., 1980 and Klinka et al., 1981). For "Suggested Succession Status" see also the discussion in 5.12.

5.12 Discussion Category

In the discussion section for each plant community I examine possible derivations or successional pathways of the communities (Figures 20 to 22), the environmental factors which seem to distinguish them from each other (see also Figures 10 to 19, 23 to 28), and related communities from the literature. The first two topics are put forward subjectively and tentatively, realizing their evaluation would benefit from further attention and research.

The origins and derivations of the plant communities are suggested based on a review of plant composition and the changes expected with disturbance and recovery, anticipated from my previous experience. Specific temporal information was not available, but there seemed to be a good recovery in community composition since Roemer's (1972) study on the Saanich Peninsula. I attributed these positive changes to the length of time since the removal of livestock grazing. My summaries (Erickson, 1994c) and the literature on grazing effects provided another source of information used in extrapolating the origins and derivations (e.g. United States Department of Agriculture, Forest Service, 1937; McLean and Marchand, 1968; McLean, 1979; Holmes, 1990). For retrogression I primarily aligned the sequence from a native plant community to a first-order disturbance community, to a second-order disturbance community. In recovery, I have reversed the trend for simplicity. This would correspond to traditional successional models (e.g. Drury and Nisbett, 1973). However, my version of this model includes periodic understory fire, as a process with effects conditioning the natural composition of plant communities. This view is consistent with that for other grasslands and open forests (e.g. Wright and Bailey, 1982; Erickson, 1984a; Reed and Sugihara, 1987; Holmes, 1990) and is now accepted in the biodiversity guidelines for the management of forest land in British Columbia (British Columbia of Forests, 1995). British Columbia's Garry oak habitat falls within a mediterranean climate (Kerr, 1951; di Castri, 1981) which promotes conditions for frequent fires, leading to adaptive characteristics in oak (Rundel, 1980).

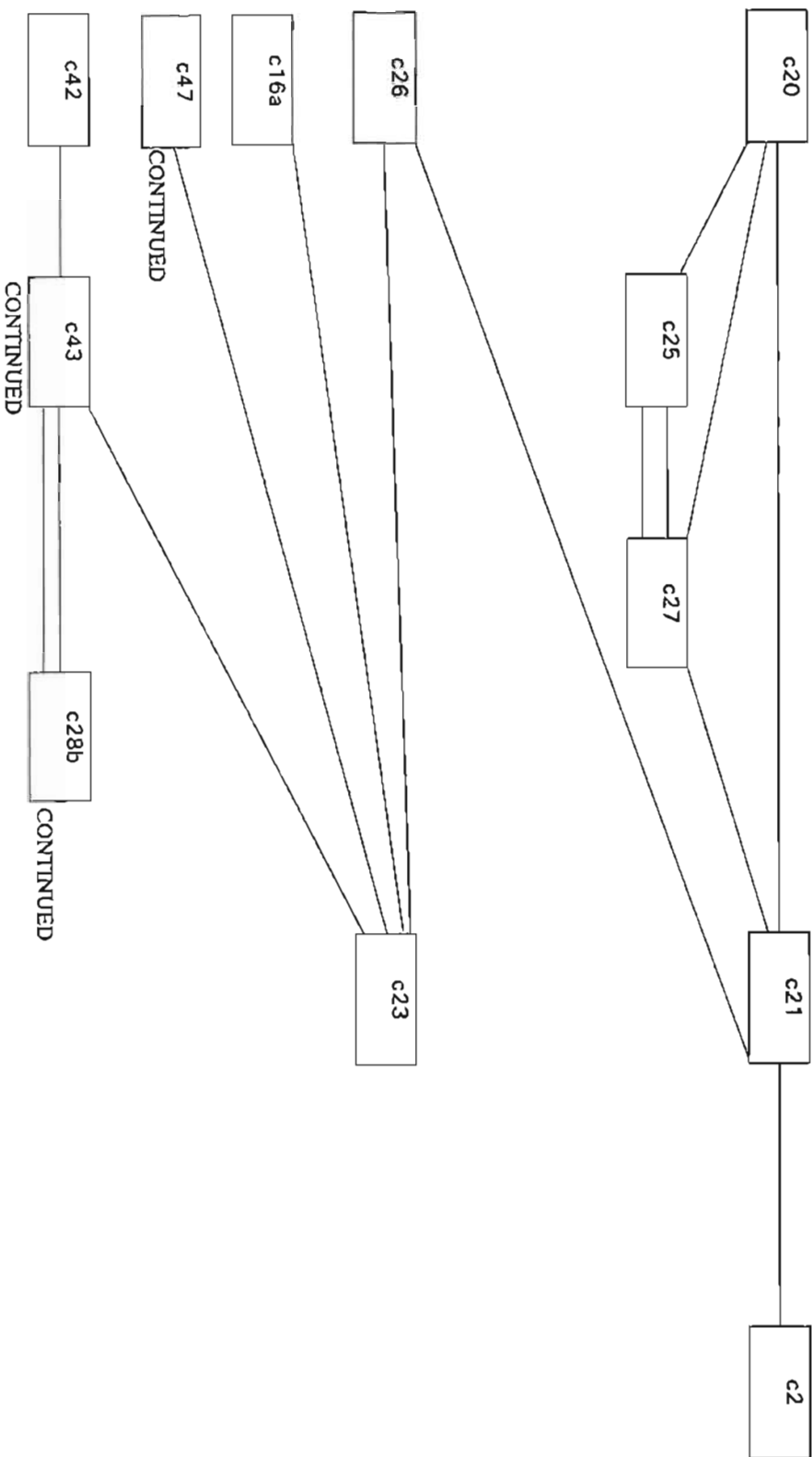


PLANT COMMUNITIES:

- c35a: Oak - *Camassia quamash* - *Erythronium oregonum*
- c35b: Oak - *Camassia quamash* - *Dodecatheon hendersonii*
- c37b: Oak - *Camassia quamash* - *Ranunculus occidentalis*
- c37a: Oak - *Camassia quamash* Typic
- c36: Oak - *Camassia leichtlinii*
- c11: Oak - *Dicranum scoparium* - *Montia parvifolia*
- c45: Oak - *Dicranum scoparium* - *Sedum spathifolium*
- c52: Oak - *Dicranum scoparium* Typic
- c48: Oak - *Montia perfoliata*
- c46: Oak - *Rhacomitrium canescens* - *Selaginella wallacei*

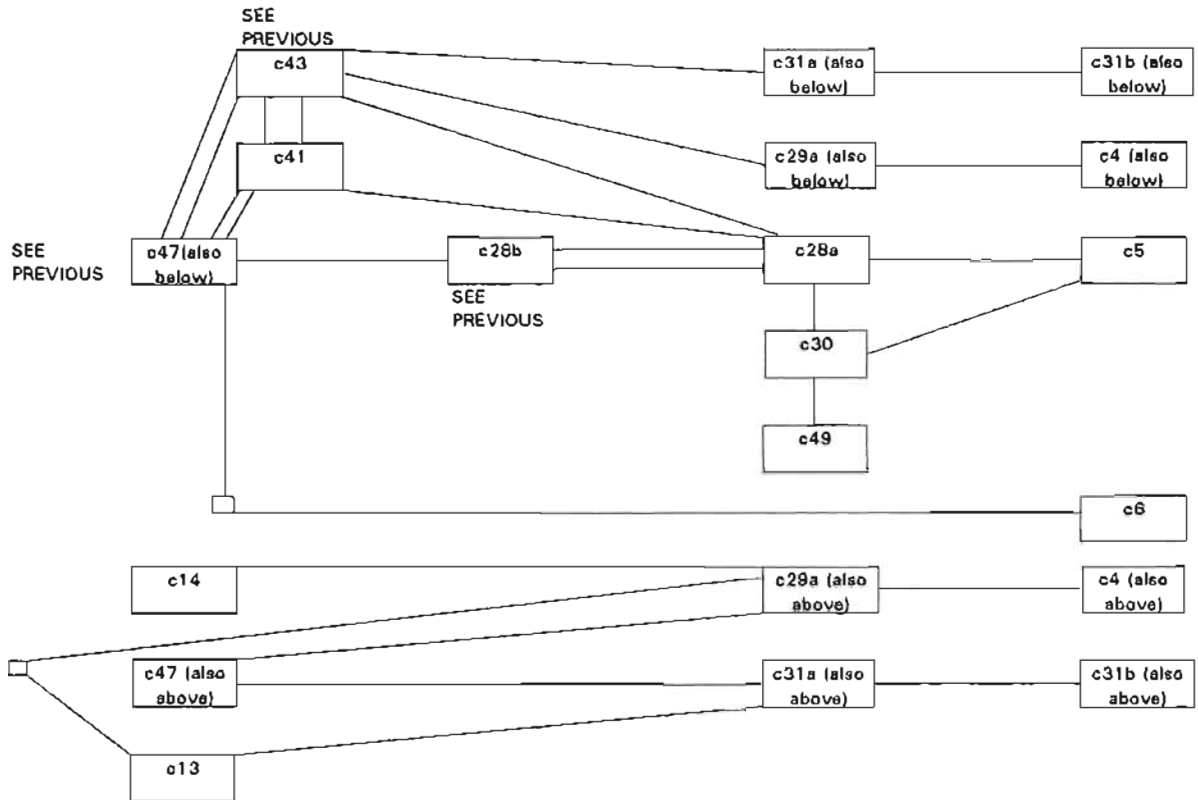
- c50: Oak - *Rhacomitrium canescens* - *Festuca bromoides*
- c22: Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum*
- c3: Oak - Broom - *Rhacomitrium canescens* - *Festuca bromoides* - Aire
- c17: Oak - Broom - *Rhacomitrium canescens* Typic

Notes: These origins and derivations of the plant communities are suggested to have occurred as a result of disturbance and understory succession.
 No successional role is suggested for c51: Oak - *Dicranum scoparium* - *Plectritis congesta*



- c20: Oak - Festuca idahoensis Typic
- c26: Oak - Mahonia aquifolium
- c16a: Oak - Lonicera hispidula
- c47: Oak - Elymus glaucus
- c42: Krummholz Oak - Festuca idahoensis - Vicia americana
- c25: Oak - Festuca idahoensis - Cersatium arvense
- c27: Oak - Festuca idahoensis - Trifolium microcephalum
- c43: Oak - Bromus carinatus
- c28b: Oak - Dactylis glomerata - Bromus carinatus
- c23: Oak - Bromus sterilis
- c21: Oak - Cynosurus echinatus
- c2: Oak - Broom - Cynosurus echinatus

These origins and derivations of the plant communities are suggested to have occurred as a result of disturbance and underlying succession.



PLANT COMMUNITIES:

- | | |
|---|--|
| c43: Oak - <i>Bromus carinatus</i> | c49: Oak - <i>Dactylis glomerata</i> - <i>Agrostis stolonifera</i> |
| c41: Oak - <i>Festuca Idahoensis</i> - <i>Vicia americana</i> | c29a: Oak - <i>Poa pratensis</i> - <i>Vicia sativa</i> |
| c47: Oak - <i>Elymus glaucus</i> | c31a: Oak - <i>Anthoxanthum odoratum</i> |
| c14: Oak - <i>Carex inops</i> | c5: Oak - Broom - <i>Dactylis glomerata</i> |
| c13: Oak - <i>Melica subulata</i> | c6: Oak - Broom - <i>Elymus glaucus</i> |
| c28b: Oak - <i>Dactylis glomerata</i> - <i>Bromus carinatus</i> | c4: Oak - Broom - <i>Poa pratensis</i> |
| c28a: Oak - <i>Dactylis glomerata</i> | c31b: Oak - Broom - <i>Anthoxanthum odoratum</i> |
| c30: Oak - <i>Dactylis glomerata</i> - <i>Arrhenatherum elatius</i> | |

Notes: These origins and derivations of the plant communities are suggested to have occurred as a result of disturbance and understory succession.

No successional role is suggested for the communities; c15: Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza*; c10: Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidadelphus triquetris*; c9: Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis*; and c8: Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa*

Uncertainties in the traditional climax model should also be recognized, both for orderly succession and the predominance of climate, as well as for the reversal of disturbance effects in recovery. Observations of difficulties in recovery have led to the development of an alternative hypothesis, the state and transition model (Westoby et al., 1989). Recovery would not be automatic and management input (treatments) might be required to move the sites away from lower condition vegetation. Garry oak communities have long-term occupancy and former dominance within the British Columbia range (see 2.2). They have distinctive soils which they helped form and which would serve to maintain their hold on the sites (see 2.4), without the unnatural disturbances since colonization (see 2.5). With this alternate view of ecosystem dynamics I am not supporting the tendency to invoke a hypothetical succession resulting in replacement by Douglas-fir. Instead, management treatments are recommended with the objective of reviving the natural vegetation order.

I have identified environmental factors which seem to distinguish the communities from a simple review and comparison of their respective features. The discussion of these features is a supplement to the charts of distribution and moisture regime and the landscape diagrams which also serve to distinguish the communities.

5.13 General Interpretations for the Garry oak habitat

There are a number of interpretations which apply to the Garry oak habitat as a whole. Some of these, such as aesthetic characteristics, are described in the background information chapter (2) and are not repeated here. The management strategy chapter (6) deals with a number of recommendations on a total habitat basis.

There was a prevalent spiritual or aesthetic regard for oaks in pre-Christian Europe, which may have been carried from human origins on the African savannah (Lewington and Streeter, 1993; Bailey and Bailey, 1994; Dwyer et al., 1994). Oaks figured in the spiritual lives of native Americans in California (Pavlik et al., 1992). Local aboriginal people recognized medicinal value from oak bark and used it in several treatments (Turner and Hebda, 1990).

Wildlife habitat characteristics are unique for oaks. In the Willamette Valley of Oregon, Guntow-Farrior (1991) found that *Quercus garryana* had substantially greater numbers of cavities than Douglas-fir. His study linked the occurrence of these cavities, which are essential for the maintenance of a diverse fauna, with large diameter and physiognomy (groves) of the oaks. Previous studies in the same area had indicated greater numbers of cavity-using species in the oak stands than Douglas-fir (op.cit.). Rough furrowed bark is a habitat characteristic of larger oaks which supports microhabitats for insects, in turn attracting bark gleaners such as brown creepers (*Certhia familiaris*) and red-breasted nuthatches (*Sitta canadensis*). The acorns produced by Garry oak are a special food resource which attracts Steller's jays (*Cyanocitta stelleri*), band-tailed pigeons (*Columba fasciata*), deer (*Odocoileus hemonius columbianus*), deer mice (*Peromyscus maniculatus angustus*) and other species. My observations of bottomland oaks suggest the importance of the acorns for ducks and geese and the beneficial role of the tree for salmonids by providing shade, cover and a surplus of food from detritus and the galls from the jumping gall wasps.

Vascular flora are covered elsewhere in the text. I observed high covers of epiphytic lichens on oaks in my sampling. These lichens, many of which are of fruticose form, represent microhabitat for insects and other fauna. Ryan (1993) mentions that the branches and twigs often support a large number of lichens such as *Ramalina farinacea* and *Usnea*. Ryan found three new species out of a total of only 12 trees examined. Pike (1973) found 104 lichens species on *Quercus garryana* of the Willamette Valley. Ryan (1993) lists three rare and endangered non-vascular cryptogam species associated with the Garry oak habitat: *Phaeoceros hallii*, a hornwort, *Bartramia sticta* and *Tortula laevipilia*, both mosses.

Some fauna are unique to Garry oak. Studies by Evans (1985) identified over 800 species of insects associated with the tree. The 'vulnerable' status propertius duskywing (*Erynnis propertius*) butterfly is dependent on oak for its larval stage (Guppy, 1993). Two lost subspecies of butterflies, large marble (*Euchloe ausonoides*

ssp.-extinct) and chalcedon checkerspot (*Euphydryas colon perdiccas*- extirpated), were linked to the Garry oak habitat. The endangered Barry's hairstreak (*Mitoura barryi*) and zerene fritillary (*Speyeria zerene bremneri*) rely on rocky mountain juniper (*Juniperus scopulorum*) and violets (*Viola* spp.) from the Garry oak habitat (op.cit.).

The potential role of the Garry oak communities in adapting to climate change has been mentioned in Chapter 2. Preserving the tree and other species should prevent resource losses (such as the effects of erosion) and financial losses (such as rehabilitation costs) (British Columbia Heritage Conservation Branch, 1983). With the present water shortages, promoting the Garry oak communities in parks and urban yards could save substantial environmental and financial costs through water conservation (e.g. Greater Vancouver Water District, n.d.).

Interpretations Category

Interpretations for the individual plant communities are given in this chapter and are intended to form a component in the overall strategy outlined in Chapter 5. The interpretations consist of subjectively assigned characteristics, uses or values. They are from my general experience and observation from the data collection, literature review, or other involvement with the topic of Garry oak ecosystems. Many of these interpretations are generalized, and result from the application of a framework which I developed for each category to the plant communities, followed by refinement based on their individual characteristics. One such interpretive framework was the Physiognomic Type classification developed in another study (Erickson, 1993c). The characteristics of the types were assigned to the plant communities and allowed to repeat in the community by community descriptions.

The interpretations are designed to provide considerations or suggest action in management decision-making within the context of the overall strategy in Chapter 7. Each site should also be considered individually, rather than to simply rely on the generalizations. The scales used for the interpretations are relative, so for example a low rating for a category does not justify dismissing the value of a plant community for a particular attribute, nor does it compare with a low rating for an outside set of

communities. In addition, in evaluating the individual plant communities consideration should also be given to the general interpretations for the Garry oak habitat outlined in 5.13.

Preservation Priority:

Preservation priority is the most important interpretive category and should be considered first in the assessment of an area. I assigned rankings to the plant communities based on the following scale which I developed to emphasize the composition of native species:

- Very high) - native plant communities of bedrock outcrops
- other native plant communities
- early-season native plant communities: or,
- High) - early-season native plant communities with a possible natural understory succession role
- Moderately high) - first-order disturbance plant communities which are dominated partly by native species
- Moderate) - second-order disturbance plant communities which are dominated partly by native species
- Low) - the remainder of the first-order disturbance plant communities
- Very low) - the remainder of the second-order disturbance plant communities

The assignment of preservation priority should be further refined by a consideration of geographic area. There is a generalized rating of susceptibility to destruction (threats) which takes into account each geographic area. Meeting the objective of preserving whole landscapes and the deep soil parkland types would require an adjustment in the ratings. A site-specific assessment could add other factors, such as composition of native species.

Regeneration: (see also 4.3)

I used the regeneration descriptions for oak on my plots to assess regeneration potential. I felt I could apply these observations because my sampling was adequate, there had been two good acorn years (1990, 1992) and variation in the yearly climates of the regeneration period. This section provides a description of regeneration further to that in the ecosystem description. The regeneration results could be use to augment some of the other categories. In the text I have used the term "normal" to describe regeneration in a non-statistical way, denoting values not subjectively distinguishable from the general mid-range of the results. Leading up to the observed younger seedling regeneration, there were heavy acorn crops in 1990 and 1992. After the study, 1994 and 1995 were also heavy crop years. Although I do not have records before this, Hebda (1993b) reported that acorn production was suppressed in the early 1980s and abundant in the mid-1980s. Records are lacking to account for older seedlings or saplings. Research in Oregon (Hibbs and Yoder, 1993) suggests that the transition from seedling to sapling may take up to 35 years: a substantial duration compared with conifers.

Wildlife Habitat and Use:

I assigned Physiognomic Type classes (5.11) and their wildlife habitat attributes (Erickson, 1993c) to the plant communities. This treatment should provide useful generalizations and allow interpretations by individual plant species (Thomas et al., 1979; Block and Morrison, 1987), although these elements were part of a wildlife habitat classification (Erickson, 1993c) and lose some information in the transfer. In addition, a physiognomic classification is generally thought to portray wildlife use and habitat attributes more accurately than a plant species classification (MacArthur and MacArthur, 1961; Cody, 1974; Harcombe, 1984). Forage preference, the use and role of wildlife, the resources of individual plant communities and butterfly use were added to the physiognomic type information. Wildlife habitat attributes for particular species were included where there were specialized features. However, there are many other species with a more general and widespread use

which are not addressed by such an approach.

Some of the wildlife habitat and use attributes are derived from my field study and some from the literature (e.g. Pyle, 1981; Blower, 1982; Orchard, 1984; Weston and Stirling, 1986; Nyberg and Janz, 1990), local observations or the characteristics of the plant species themselves. Wildlife use and wildlife habitat niche features (bedrock and rock crevices, dead main stems, etc.) were recorded on my plots (Appendix 2). Some relevant size criteria are: crevices < 2 cm; cavities > 2 cm; hollows > 20 cm; small dead limbs < 2 cm; medium dead limbs 2 to 10 cm; large dead limbs > 10 cm. These characteristics are put forward as wildlife habitat attributes on the premise that structural diversity of canopy, key features or the elements of site habitat represent potential niches for wildlife (Stiles, 1973; Thomas et al., 1979; Backhouse, 1993). Many of these features are recognized in other wildlife guilds (Anderson et al., 1979; Verner, 1980a; Block et al., 1984; Wilson et al., 1991), life-forms (Thomas et al., 1979) or structural vegetation wildlife groups (Short and Williamson, 1984).

Aesthetic / Recreational:

The physiognomic types were assigned aesthetic classes. An overall rating was developed numerically from classes developed in four categories: physiognomic type, oak form-class, form-complexity index and diameter. Oak form-class emphasized openness and, together with average diameters, indexed the positive aesthetic characteristics of large size. Oak form-complexity was computed numerically and the values used in classes, on my assumption that the greater the complexity, the greater the aesthetic appeal. Physiognomic type classes reflected the properties of diversity and openness. The assessments were modified with factors such as the presence of early-season flowering plant communities. Recovery from the current insect outbreaks was assumed for the purposes of these interpretations .

These assessments are compatible with the fact that aesthetic/ recreational values are inherently subjective. I derived the focus primarily from my four year study of oak woodlands in the Pacific Northwest. The treatment reflects what I perceive

to a consensus. For example, I rated open parkland physiognomic types very high in aesthetic appeal and Litton (1980) points out that a highly contrasting mosaic of grass and oak woods is a distinctive pattern contributing to scenic quality. Gobster (1994) notes the attraction of oak landscapes with the right balance of trees and open areas and points out this relationship is borne out by several studies. Similarly I indexed the large size attributes positively and Litton (1980, p.165) states that "the enduring dominance of a single large oak tree in the local landscape is significant and without substitute." Several studies have shown high aesthetic preference for mature trees (Gobster, 1994). Oak form-class and complexity represent visual diversity and the difference between oaks and, say, Douglas-fir. Visual diversity is a standard element of aesthetic evaluation (e.g. British Columbia Ministry of Forests, 1981) which seems applicable to oak. The quote from British Columbia Conservation Data Centre (1992) in section 2.7 and various selections of oaks for posters, illustrations and text descriptions all focus on features which are part of visual diversity. According to Gobster (1994) landscape preference research has shown the desirability of a high overstory canopy, which would correspond to the oak form-classes rated highly in this study. Gobster discusses the intuitive appeal of oak's horizontal branching, as well as the visual attraction of trees with diverse trunks, highlighting the importance of form-diversity in aesthetics.

The physiognomic types were given aesthetic ratings as follows, from highest to lowest: open parklands, krummholz sea-edge, oak-light shrub cover-herb parkland, oak - talus; shrub oak-rock outcrop, other parklands, shrub oak basin; oak woodlands, oak-fern rockland, shrub oak-basin broomland, shrub oak-broom-rockland; broom parkland, shrub oak- thicket, oak-dense shrub. Ratings were reduced by a class for first-order disturbance communities.

Susceptibility to Disturbance:

The plant communities were rated for susceptibility to disturbance using the generalizations suggested by the consolidated categories and ecological moisture regime. This assessment included susceptibility to grazing and recreational impact.

The background for this work comes from a variety of ecological work such as that on grazing impacts (see 5.12) and other assessments of susceptibility to disturbance (e.g. Mitchell et al., 1981a, b; Vold, 1982; Braumndl and Curran, 1992). Categories were assigned in the following order, from highest to lowest susceptibility: native "xeric" communities and native early-season communities; other native communities and first-order disturbance "xeric" communities; "xeric" broom communities, remainder of first-order disturbance communities, native "wet" communities; remainder of broom communities.

Prescribed Fire:

The need of the plant community for prescribed fire was assessed, then the desirability, contraindicated by the presence of responsive species ready to take over the plant community. Shrub density and possible forb rejuvenation in grass stands were the main positive vegetation indicators. It is recommended that a number of site-specific considerations such as fuel loads, stand structure, fire weather/season of burn, potential containment, etc. also be considered in any evaluation, using standard methodologies (e.g. British Columbia Ministry of Forests, 1996).

The prescribed fire interpretations are based on the important role suggested for periodic burning in the oak ecosystem, as discussed in 2.5 and 5.12. As in the American Midwest (Gobster, 1994), the common understanding from those who have studied the woodlands is that fire was a natural part of the ecosystem which served to keep it more open and park-like and control conifers and shrubs. The targeting of dense shrub cover with prescribed fire is based on personal experience and consistent with these projections. Re-establishment of frequent fire will maintain oak dominance, halt Douglas-fir encroachment and maintain natural ecosystem diversity (Sugihara and Reed, 1987). Fires serve to give advantage to oak over Douglas-fir (Erickson, 1994b). The ability to establish and persist where fire is a repeated natural occurrence contributed to Stein's (1990) rating of *Quercus garyana* as a climax species in part of its range. Among its adaptive characteristics are the propensities for seedlings to resprout (Hibbs and Yoder, 1993), for adults to stump-sprout into

mid-size classes (Griffin and Muick, 1990), relatively thick bark, clear main bole and lower branches, deciduous habit and relative low flammability. The Bald Hills experience in California (Sugihara and Reed, 1987) showed very high mortality in Douglas-fir following a prescribed fire. This burn stimulated reproduction in oak.

The basic framework for the prescribed fire assessment was as follows, from highest to lowest: moderate to dense shrub communities and early-season communities; other parklands with shrub communities or dense introduced grasses; rock outcrop types, some "xeric" or talus communities with bedrock, broom communities and "wet" shrub communities.

Threats:

The threats addressed are those posed by development. Many of the points above were considered, along with geographic area, slope and presence of bedrock as an indicator of view home locations. The geographic area assessment rated the areas in the following order of threat, from highest to lowest: Saanich Peninsula, western shore, Duncan-Nanaimo, southern Gulf Islands, northern Gulf Islands. There are also locality-specific considerations which are better built into detailed planning levels, such as proximity to municipal water, sewage systems and transportation corridors.

Restoration Potential and Priority:

Restoration is not the focus of these interpretations. However, I provide an assessment of priority and potential for use if restoration must be considered. Providing that communities had a high restoration potential, restoration priority paralleled preservation priority. The ratings for native plant communities assume a level of site disturbance from which recovery would be required. Lower priority was designated for plant communities with lower restoration potential. In addition to native communities and the two orders of disturbance communities, site quality was considered through the use of ecological moisture regime.

A caution is needed before considering rehabilitative restoration as a primary

management option. Restoration is still unproven. Natural ecosystems are so complex and poorly described, let alone understood, that focusing on rehabilitative restoration for Garry oak ecosystems is only recommended as a last-resort measure. The intention of the ratings is directed more toward the active management forms of restoration, such as seeding native cultivars. This orientation is consistent with some Canadian programs, such as those for prairie restoration where seeding native species is the definition of restoration (Nernberg, 1994).

Priority was assigned in the following order, from highest to lowest: native communities of mesic sites and early-season native communities; introduced communities of mesic sites with native species; the remaining native communities and introduced communities of mesic sites; remaining first-order communities; xeric introduced communities and remaining of broom communities.

Potential was assigned in the following order, from highest to lowest: native native wet, mesic and early-season communities; native subxeric and xeric communities, disturbed communities with native species; remaining communities.

Special Management:

Special management measures are outlined on an individual plant community basis, as the need for each was identified. I used records of hedging by physiognomic type together with regeneration to interpret deer impact on oak.

5.2 PLANT COMMUNITIES

c37a Oak - *Camassia quamash*: Typic subcommunity

Ecosystem description:

Frequency of Occurrence: 12 plots, moderately frequent

Distribution: From Plots: Hornby Is., Nanoose Hill, Mt. Tzuhalem, Saanich Peninsula: Mt. Finlayson, Thetis Lk., Uplands; western shore: Juan de Fuca Pk., Fort Rodd Hill, Rocky Pt. From Notes: western shore: Belmont Pk.

Plant Community Description: *Camassia quamash* (early camas) is present on all sites and averages class 3 cover. *Sanicula crassicaulis* (Pacific snakeroot) occurs on all sites and averages class 2 to 3 cover. *Symphoricarpos albus* (snowberry) and *Galium aparine* (cleavers) grow on most sites and average class 2 to 3, and class 1 to 2 cover, respectively.

Tree Canopy/ Landscape Expression: usually tree canopy (A) layer

Oak Characteristics: Diameters: various; Regeneration: is present on most sites for saplings and on some sites for seedlings. Stocking averages moderately well-stocked for saplings and lightly-stocked for seedlings.

Physiognomic Type: often Oak - Light Shrub - Herb - Bulb Parkland (6), some Oak - Broom - Parkland (2), Oak Woodlands (2), and others.

Suggested Successional Status: Mature Edaphic Climax to 'Mature Climatic Climax'

Constant Cover Value: 0.24 Adjusted Motyka Comparison: 1.32 Oak- *Camassia quamash*-*Erythronium oregonum* (early-season) (c35a); 0.62 Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity (early-season) (c37b); 0.59 Oak- *Camassia leichtlinii* (c36); 0.40 Oak - *Camassia quamash* - *Dodecatheon hendersonii* subcommunity (early-season) (C35b); 0.19 Oak - *Montia perfoliata* (early-season) (c48); 0.10 Oak - *Dicranum scoparium* - *Plectritis congesta* (early-season) (c51).

Elevation: various: 20 to 330 m Slope: mostly gentle Aspect: primarily southeast (south) to west Surface Shape: mainly concave (7), also straight (3), and various Moisture Regime: chiefly submesic to mesic, often with "compensating" moisture influxes (4), ranges from very xeric to permesic

Exposure: wind (9), insolation (6) Bedrock Geology: various

Surface Substrate Features: some (3) have moderate to high bedrock exposure (class 3 or 4) Soil Classification: mainly Orthic Sombric Brunisols (9), also Orthic Humic Regosols (3) Humus Classification: Vermimulls and Orthi Rhizomulls (4)

Depth of Ah Horizon: generally > 25 to 35 cm(7), or 6 to 30 cm(5)

Colour of Ah Horizon: usually dark, 10YR2/1, 2/1.5

Depth to Bedrock: mostly none, some 25 to 80 cm (estimated)

Surface Soil Texture: generally silt loam (8), gravelly and very gravelly

Percent Coarse Fragments: various

Comments: Four plots were observed to be receiving extra moisture from surrounding sites. This plant community provides one of the flower shows for which the Garry oak habitat is famous in spring.

Discussion:

The tendency toward occupancy of concave sites, which suggests moisture influxes, is an environmental characteristic distinguishing this subcommunity. The several subcommunities with *Camassia quamash* (c37a,b; c35a,b) develop about three weeks earlier than *Camassia leichtlinii* (c36). This subcommunity could be derived partly from c35 a and b through the depletion of bulbs and forbs. With further disturbance it might convert into c48, the Oak- *Montia perfoliata* plant community.

A biogeocoenose was recognized partly for *Camassia* and *Quercus* by Krajina (1969). Camas is mentioned in the description of "shallow soils and open tree canopy" with Garry Oak by Oswald (1977) for Gabriola Island. None of the other species from this community were important in c37a. Both Camas species are abundant in the meadows of the San Juan Islands (Atkinson and Sharpe, 1985). The prairies at Scatter Creek, Ft. Lewis and Rocky Prairie are reported to have common or abundant camas in the spring (Kavanaugh, 1992; Clampitt, 1993; Dickey, 1992). Camas meadows with both species have been described from the Catherine Creek area near White Salmon, Washington (Kavanaugh, 1988). *Camassia quamash* is dominant in swales on prairies both at Mima Mounds in western Washington (Chehalis Habitat Inventory Team, 1980) and the Willamette Valley, Oregon (Franklin and Dyrness, 1973). *Camassia quamash* was among the characteristic species of undisturbed Puget Sound prairies (Sharpe, in prep.) and was present with substantial cover on some of the plots in the *Bromus rigidus*/moss grassland described by Salstrom (1989) for Pt. Disney, Waldron Island, Washington.

Interpretations:

Preservation Priority: very high by general ranking

Regeneration: Regeneration potential is moderately low. Seedling regeneration only present on some sites, otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Light Shrub Cover- Herb - Bulb Parkland) to which this plant community has been assigned:

- thermal bedding and foraging on moderate to moderately steep south to west slopes and some bedrock exposure
- fresh sprouts, foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- some trees and stands with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

The following are additional characteristics of a secondary physiognomic type (Oak Woodland) of this plant community:

- high average numbers of wildlife habitat and use records
- oak and deciduous litter
- high numbers of: medium dead limbs, scaling limbs, loose bark, dead main stems, and small dead limbs.

Camas is heavily preferred as fresh sprouts in spring by deer and other grazing animals. *Sanicula crassicaulis* is also used. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer (Blower, 1982), but appears to be higher as I recorded several spring utilization records. Earthworms and other rich soil attributes are provided by this community. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus*

kennicottii); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. Woodland settings should supply particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent; and the blue-listed Hutton's vireo (*Vireo huttoni*).

Symphoricarpos albus (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as very high, especially because of the spring flower show provided by this community. The rating is also based on the following:

- mostly very high, with some low and moderate by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Camassia quamash (early camas) has cultural heritage significance for its use as an edible bulb by aboriginal people. *Symphoricarpos albus* (snowberry) adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: high to very high

Restoration Potential: very high

Restoration Priority: very high

Special Management:

Consideration should be given to *Camassia quamash* (early camas), which has yellow (potentially vulnerable) status. Early camas is cultivated and used in native plant gardening.

c35a Oak- *Camassia quamash*- *Erythronium oregonum* subcommunityEcosystem description:

Frequency of Occurrence: 5 plots, infrequent

Distribution: From Plots: Hornby Island: Downes Pt., Duncan: Priest Point, St. Peter's; Saanich Peninsula: Beacon Hill Park. From Notes: none

Plant Community Description: *Camassia quamash* (early camas) is present on all sites and averages class 3 cover. *Erythronium oregonum* (easter lily) occurs on all sites and averages class 3 to 4 cover. *Symphoricarpos albus* (snowberry) grows on all sites and averages class 3 cover. *Dactylis glomerata* (introduced orchardgrass) and *Mahonia aquifolium* (tall Oregon grape) occupy most sites and average class 2 and 1 cover, respectively.

Tree Canopy/ Landscape Expression: either tall shrub canopy (B1) layer (3) or high cover tree canopy (A) layer (2)

Oak Characteristics: Diameters: mostly small diameters (4);

Regeneration: Regeneration is occurring on most sites. Stocking for saplings averages moderately well- to well-stocked. Stocking for seedlings averages lightly-stocked.

The averages reported here are lower because two of these plots are mowed annually, suppressing regeneration.

Physiognomic Type: various: some Oak - Light Shrub - Herb - Bulb - Parkland (2).

Suggested Successional Status: Mature Climax

Constant Cover Value: 0.42 Adjusted Motyka Comparison: 1.32 Oak - *Camassia quamash*: Typic (early-season) (c37a); 0.61 Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity (early-season) (c37b); 0.23 Oak - *Camassia quamash* -

Dodecatheon hendersonii subcommunity (early-season) (C35b).

Elevation: low to medium elevation Slope: mostly gentle

Aspect: southeast (south) to west Surface Shape: various

Moisture Regime: chiefly mesic (3), also xeric, subxeric

Exposure: insolation (3), wind (2)

Bedrock Geology: conglomerate (2), no data (2)

Surface Substrate Features: few features

Soil Classification: Orthic Sombric Brunisols (3) and Regosols (2)

Humus Classification: mainly Orthi Vermimulls (4)

Depth of Ah Horizon: 5, 20 cm, or > 10 to 15 cm

Colour of Ah Horizon: dark, 10YR2/1 Depth to Bedrock: none (3), or shallow, 5, 20 cm Surface Soil Texture: sandy loam to silt loam

Percent Coarse Fragments: none (2), or no data

Comments: This plant community provides one of the flower shows for which the Garry oak habitat is famous in spring.

Discussion:

This subcommunity is partly distinguished by a mesic ecological moisture regime. With small amounts of disturbance, this community might convert into c37b, and with greater disturbance into c48.

The *Quercus-Erythronium* (QE) (Roemer, 1972) has little similarity other than its name, with only one other species in common. *Erythronium oregonum* was a characteristic indicator of a type described for the Saanich Peninsula by Szczawinski and Harrison (1973). Pattison and Karanka (1981) mentioned the species in their key to the Garry Oak-hairy honeysuckle-California fescue (oatgrass ?) vegetation unit on Galiano and smaller islands. *Erythronium oregonum* was among the characteristic species of the oak woodland association for the area north of the Siskiyou described by Stoutamire (1951) and was present in the *Lomatium martindalei* provisional association from the non-oak Oregon "balds" (Aldrich, 1972). The recollections of

early settlers suggested an abundance of *Erythronium oregonum*, now absent from the Oak Patch site near Bremerton, Washington (Kertis, 1986). There is a discussion of *Camassia quamash* in c37a and *Mahonia aquifolium* in c26.

Interpretations:

Preservation Priority: very high by general ranking

Regeneration: Regeneration potential is moderate. Current regeneration is normal, except saplings are moderately well- to well-stocked (above average).

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Light Shrub Cover- Herb - Bulb Parkland) to which this plant community has been assigned:

- thermal bedding and foraging on moderate to moderately steep south to west slopes
- fresh sprouts, foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- some trees with the following: high numbers of tree crevices/cavities, high number of perches, large dead limbs, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Earthworms and other rich soil attributes are provided by this community. Camas is heavily preferred as fresh sprouts in spring by deer and other grazing animals. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis*

californicus). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions.

Symphoricarpos albus (snowberry) is one of the noted nectar producers for Rufous-sided hummingbird, Anna's hummingbird, probably serves for butterflies and is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*).

Aesthetic / Recreational:

Overall aesthetic appeal is rated as very high, especially because of the spring flower show provided by this community. The rating is also based on the following:

mostly very high, with some low, by physiognomic type

- low by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Camassia quamash (early camas) has cultural heritage significance for its use as an edible bulb by aboriginal people. *Symphoricarpos albus* (snowberry) adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: high to very high

Restoration Potential: very high

Restoration Priority: very high

Special Management:

Consideration should be given to *Camassia quamash* (early camas) and *Erythronium oregonum* (easter lily), which have yellow (potentially vulnerable) status. *Camassia quamash* (early camas) and *Erythronium oregonum* (easter lily) are cultivated and used in native plant gardening.

c35b Oak - *Camassia quamash* - *Dodecatheon hendersonii* subcommunity

Ecosystem description:

Frequency of Occurrence: 4 plots, infrequent

Distribution: From Plots: Duncan: Genoa Bay, Mt. Tzuhalem, Priest Pt.

From Notes: none

Plant Community Description: *Camassia quamash* (early camas) is present on all sites and averages class 2 to 3 cover. *Dodecatheon hendersonii* (broad-leaved shootingstar) occurs on all sites and averages class 3 cover.

Rhacomitrium canescens (gray frayed-cap moss) grows on all sites and averages class 3 cover. *Elymus glaucus* (blue wildrye) and *Polytrichum juniperinum* (juniper hair-cap moss) exist on all sites and average class 2 cover. *Galium aparine* (cleavers) occupies all sites and averages class 1 to 2 cover. *Achillea millefolium* (yarrow), *Rumex acetosella* (introduced sheep sorrel), and *Stellaria media* (introduced chickweed) are present on all sites and average class 1 cover.

The remaining species are present on most sites. *Cytisus scoparius* (introduced broom) averages class 3 cover. *Symphoricarpos albus* (snowberry), *Carex inops* (long-stoloned sedge), and *Dicranum scoparium* (broom moss) average cover class 2.

Mahonia aquifolium (tall Oregon grape), *Bromus carinatus* (California brome grass), *Luzula multiflora* (many-flowered woodrush), *Plectritis congesta* (seablush), *Sanicula crassicaulis* (Pacific snakeroot), *Brodiaea coronaria* (harvest brodiaea), *Lomatium utriculatum* (spring gold), *Collinsia parviflora* (small-flowered blue-eyed Mary), and *Trifolium oliganthum* (few-flowered clover) average class 1 cover.

Tree Canopy/ Landscape Expression: either tree canopy (A) layer (2), or tall shrub (B1) layer canopy (2)

Oak Characteristics: Diameters: small diameter; Regeneration: Regeneration is present on some sites for saplings and on all sites for seedlings. Average stocking level is light for both saplings and seedlings.

Physiognomic Type: various: some Oak - Light Shrub - Herb - Bulb Parkland (2).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.68 Adjusted Motyka Comparison: 0.40 Oak - *Camassia quamash*: Typic subcommunity (early-season) (c37a).

Elevation: usually high elevation, 170 to 275 m Slope: gentle to moderate

Aspect: south and west to north Surface Shape: various

Moisture Regime: mostly subxeric to submesic (one xeric)

Exposure: wind (3), insolation (2) Bedrock Geology: conglomerate (2), slate (2)

Surface Substrate Features: some (2) have moderately high to very high (class 3 to 6) bedrock exposure Soil Classification: Orthic Sombric Brunisols (2) or Regosols (2)

Humus Classification: primarily Vermimulls Depth of Ah Horizon: generally 8 to 15 cm (3) Colour of Ah Horizon: usually dark, 10YR2/1, 2/1.5 (3)

Depth to Bedrock: some shallow, 8 and 15 cm, some with none (1), or at depth (60 cm, estimated) (1) Surface Soil Texture: gravelly and very gravelly loam

Percent Coarse Fragments: mainly high surface coarse fragments

Comments: This plant community provides one of the flower shows for which the Garry oak habitat is famous in spring.

Discussion:

Occurrence on bedrock ledges is one environmental characteristic distinguishing this subcommunity. Occurrence at high elevation is probably a second feature which demarcates. With disturbance, it might convert into c37a.

There are no types classified for these species in the literature on oak woodlands. *Dodecatheon hendersonii* was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). *Luzula multiflora* was one other from c35b. *Dodecatheon hendersonii* is mentioned for Gabriola Island in the description of "shallow soils and open tree canopy" with Garry oak by Oswald (1977). *Collinsia grandiflora*, not *C. parviflora* (as in c35b) was also present. One oak savannah plot on Cady Mt., Waldron Island, Washington was dominated by *Camassia quamash* and *Dodecatheon hendersonii* (Washington

Conservation Data Centre, 1993). *Dodecatheon hendersonii* was among the characteristic species of the oak woodland association listed by Stoutamire (1951) for the area north of the Siskiyou and was dominant on the Mima Mounds prairie in western Washington (Chehalis Habitat Inventory Team, 1980) and is found further south around Annadel State Park, Sonoma Co., California (Anderson and Pasquinelli, 1984).

There is a discussion of *Camassia quamash* in c37a, *Plectritis congesta* in c51 and *Carex inops* in c14.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is low. Saplings are only present on some sites, and only lightly-stocked. Seedlings present on all sites. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Light Shrub Cover- Herb - Bulb Parkland) to which this plant community has been assigned:

- thermal bedding and foraging on moderate to moderately steep south to west slopes and some bedrock exposure
- fresh sprouts, foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- some trees with the following: high number of tree crevices/cavities, high number of perches, large dead limbs, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Earthworms and other rich soil attributes are provided by this community. Camas and *Brodiaea coronaria* are heavily preferred as fresh sprouts in spring by deer and other grazing animals. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. Trees or stands of large diameter and high numbers of tree

cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions.

Symphoricarpos albus (snowberry) is one of the noted nectar producers for Rufous-sided hummingbird, Anna's hummingbird, probably serves for butterflies and is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). Composites such as *Achillea millefolium* (yarrow) provide nectar for butterflies such as silvery blue (*Glaucopsyche lygdamus*), mylitta cresecent spot (*Phycoides mylitta*) and painted ladies (*Vanessa cardui*, *V.annabella*). *Lomatium utriculatum* (spring gold) is probably a larval and nectar source for Anise swallowtail (*Papilio zelicaon*) and a nectar plant for silvery blue (*Glaucopsyche lygdamus*), which use *Lomatium*. *Trifolium oliganthum* (few-flowered clover) is probably a larval food plant for northern cloudywing (*Thorybes plyades*) and the endangered greenish blue (*Plebejus saepiolus insulanus*), both of which use *Trifolium*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as very high, especially because of the spring flower show provided by this community. The rating is also based on the following:

- mostly very high, with some low, by physiognomic type
- low by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Symphoricarpos albus (snowberry) adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Plectritis*

congesta (seablush), *Brodiaea coronaria* (harvest brodiaea), *Lomatium utriculatum* (spring gold), *Collinsia parviflora* (small-flowered blue-eyed Mary), and *Trifolium oliganthum* (few-flowered clover) add to the appeal of this community with their flowering, although present in small amounts. *Carex inops* (long-stoloned sedge) and *Achillea millefolium* (yarrow) add late-season appeal by staying green into the summer. *Camassia quamash* (early camas) has cultural heritage significance for its use as an edible bulb by aboriginal people, *Achillea millefolium* (yarrow) for its medicinal use.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: high

Restoration Potential: very high

Restoration Priority: very high

Special Management:

Consideration should be given to *Camassia quamash* (early camas), *Clarkia amoena* (farewell-to-spring), *Brodiaea coronaria* (harvest brodiaea), *Lomatium utriculatum* (spring gold), *Trifolium oliganthum* (few-flowered clover), and *Piperia elegans* (*Platanthera unalascensis* ssp. *elata*), a species which this community seems to provide habitat for; all with yellow (potentially vulnerable) status. *Camassia quamash* (early camas), *Brodiaea coronaria* (harvest brodiaea) and *Dodecatheon hendersonii* (broad-leaved shootingstar) are cultivated and used in native plant gardening.

c37b Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity

Ecosystem Description:

Frequency of Occurrence: 6 plots, moderately frequent in certain areas

Distribution: From Plots: Nanoose Bay: Dolphin Hill; Saturna Island: Mt. Warburton-Pike; Saanich Peninsula: Uplands, Summit Pk., Anderson Hill Pk., Beacon Hill Pk. From Notes: none

Plant Community Description: *Camassia quamash* (early camas) and *Ranunculus*

occidentalis (western buttercup) are present on all sites and average class 3 cover. *Poa pratensis* (introduced Kentucky bluegrass) and *Vicia sativa* (introduced common vetch) occur on all sites and average class 2 cover. *Dactylis glomerata* (introduced orchardgrass) grows on most sites and averages class 2 cover. *Stellaria media* (introduced chickweed) exists on most sites and averages class 1 to 2 cover.

Tree Canopy/ Landscape Expression: mostly tree canopy (A) layer

Oak Characteristics: Diameters: various: 5.9 cm to 89.9 cm;

Regeneration: Regeneration of saplings is occurring on most sites. Stocking averages lightly- to moderately well-stocked. There was no seedling regeneration.

Physiognomic Type: usually Oak - Light Shrub - Herb - Bulb Parkland (4).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.34 Adjusted Motyka Comparison: 0.62 Oak - Camassia quamash: Typic subcommunity (early-season) (c37a); 0.61 Oak- Camassia quamash- Erythronium oregonum subcommunity (early-season) (c35a).

Elevation: various, 30 to 415 m Slope: chiefly gentle (5), one is steep

Aspect: mainly south-south-east (south) to west-south-west (4)

Surface Shape: various Moisture Regime: submesic to subxeric

Exposure: insolation (3), wind (2)

Bedrock Geology: coarse: granitic, sandstone, conglomerate (3), and slate (2)

Surface Substrate Features: some (3) with moderate to high bedrock exposure (class 3 or 4) Soil Classification: primarily Orthic Sombric Brunisols (5)

Humus Classification: generally Orthi Rhizomulls

Depth of Ah Horizon: 20 to 37 cm (3), or > 10 to 20 cm (3)

Colour of Ah Horizon: usually dark, 10YR2/1, 2/1.5 (5)

Depth to Bedrock: none (3), or 20 to 50 cm (estimated) (3)

Surface Soil Texture: mostly silt loam

Percent Coarse Fragments: low to medium (3), and no data (3)

Comments: This plant community provides one of the flower shows for which the Garry oak habitat is famous in spring.

Discussion:

Fine textured- silt loam and deep *Ah* horizons are soil features which may partly distinguish this subcommunity. It could be derived from c35a or b through the depletion of bulbs or forbs by grazing or mowing. However, this subcommunity is a deeper soil type than these others. With disturbance, it might convert into c48.

Ranunculus occidentalis was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). It was among the characteristic species of the oak woodland association for the area north of the Siskiyou described by Stoutamire (1951) and was a typical species of the grasslands of the Willamette Valley (Franklin and Dyrness, 1973) and has been described as characteristic of undisturbed Puget Sound prairies (Sharpe, in prep.). One oak savannah of Cady Mt. on Waldron Island, Washington is described as having brilliant floral displays of *Camassia quamash* and *Ranunculus occidentalis* (Washington Conservation Data Centre, 1993).

There is a discussion of *Camassia quamash* in c37a.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is poor. Seedlings are absent. Saplings are normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Light Shrub Cover- Herb - Bulb Parkland) to which this plant community has been assigned:

- thermal bedding and foraging on moderate to moderately steep south to west slopes and some bedrock exposure
- fresh sprouts, foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- some trees and stands with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs

and decaying logs, loose bark, hollow logs or tree hollows.

Camas is heavily preferred as fresh sprouts in spring by deer and other grazing animals. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions.

Aesthetic / Recreational: Overall aesthetic appeal is rated as very high, especially because of the spring flower show provided by this community. The rating is also based on the following:

- mostly very high, with some low, by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Camassia quamash (early camas) has cultural heritage significance for its use as an edible bulb by aboriginal people. *Stellaria media* (introduced chickweed) is edible, and could be eaten for enjoyment on unpolluted sites.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: high to very high

Restoration Potential: very high

Restoration Priority: very high

Special Management:

Consideration should be given to *Camassia quamash* (early camas) which has yellow (potentially vulnerable) status. Early camas is cultivated and used in native plant

gardening.

c36 Oak - *Camassia leichtlinii*

Ecosystem Description:

Frequency of Occurrence: 50 plots, very frequent

Distribution: From Plots: widespread: Nanaimo, southern Gulf Islands, Saanich Peninsula, western shore, not detected for Hornby Is., Gabriola Is., Duncan's eastern shore, Saturna Is. and Saltspring Is. From Notes: Observatory Hill, western shore: Rocky Pt. This community was so common it often was not recorded.

Plant Community Description: *Camassia leichtlinii* (great camas) is present on all sites and averages class 3 cover. The other species listed are present on most sites. *Symphoricarpos albus* (snowberry) averages class 3 cover. *Poa pratensis* averages class 2 to 3 cover. *Elymus glaucus* (blue wildrye), *Sanicula crassicaulis* (Pacific snakeroot), *Galium aparine* (cleavers), *Vicia hirsuta* (introduced hairy vetch), and *Vicia sativa* (introduced common vetch) average class 2 cover.

Tree Canopy/ Landscape Expression: mostly tree canopy (A) layer

Oak Characteristics: Diameters: various; Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Stocking of saplings averages moderately well-stocked. Seedlings average lightly-stocked.

Physiognomic Type: various: often Oak - Light Shrub - Herb - Bulb - Parkland (15), some Shrub Oak - Rock Outcrop (6), Oak - Broom Parkland (6), Shrub Oak - Basin (5), and others.

Suggested Successional Status: Mature Edaphic Climax, some Mature Climatic Climax and Mature Disclimax from Mature Climatic Climax

Constant Cover Value: 0.37 Adjusted Motyka Comparison: 0.68 Oak - *Montia perfoliata* (early-season) (C48); 0.68 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (C51); 0.58 Oak- *Camassia quamash*: Typic (c37a).

Elevation: various Slope: usually gentle to moderately steep

Aspect: various Surface Shape: various Moisture Regime: very xeric to permesic

Exposure: insolation, wind, seaspray Bedrock Geology: various

Surface Substrate Features: plots often (27) have either moderately high to very high bedrock exposure (class 3 to 6) (21) or moderately high to high (class 3 to 5) surface rocks (16)

Soil Classification: generally Orthic Sombric Brunisols (32) or Regosols (16)

Humus Classification: Vermimulls and Rhizomulls

Depth of Ah Horizon: primarily > 10 to 35 cm (26), or 4 to 40 cm

Colour of Ah Horizon: mainly dark, 10YR2/1

Depth to Bedrock: chiefly none, or 4 to 70 cm (estimated) (21)

Surface Soil Texture: usually loam to silt loam, gravelly and very gravelly

Percent Coarse Fragments: various, partly with high subsurface coarse fragments (21)

Comments: This plant community is one of the showy flower meadows for which the Garry oak habitat is famous in spring.

Discussion:

This community may be partly distinguished by its association with fine textured soils-- loam to silt loam,-- and by deep *Ah* horizons. *Camassia leichtlinii* develops about three weeks later in the spring than the various *Camassia quamash* communities (c35 a, b, c37a, b). With disturbance, this community might convert into c48. Its core is on the Saanich Peninsula and western shore (see 5.11) in contrast to the several *Camassia quamash* subcommunities which seem to be best developed in the Duncan area.

There are no types classified for these species in the literature on oak woodlands. *Camassia leichtlinii* was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). *Camassia leichtlinii* was part of a community described by Janszen (1981) for Mayne Island and was among the characteristic species of the oak woodland association described by Stoutamire (1951) for the area north of the Siskiyou. There is a discussion of *Camassia leichtlinii* in c37a and *Symphoricarpos albus* in c15.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderate. Current regeneration is normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Light Shrub Cover- Herb - Bulb Parkland) to which this plant community has been assigned:

- thermal bedding and foraging on moderate to moderately steep south to west slopes, many with bedrock or rock exposure
- fresh sprouts, foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- some trees and stands with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Camas is heavily preferred as fresh sprouts in spring by deer and other grazing animals. Earthworms and other rich soil attributes are provided by this community. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions.

Some stands have the following additional characteristics associated with a secondary physiognomic type (Oak - Broom -Parkland):

- high average numbers of wildlife habitat and use features, high numbers of utilization detections, high numbers of bird species recorded

- browse and seeds for wildlife, and dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all provided by broom
- high numbers of bark crevices, high numbers of small, medium, and scaling dead limbs

Other stands have the following additional physiognomic type characteristics (Shrub Oak -Basin):

- potential for attracting chaparral bird species, increased food for foliage gleaners due to relatively more insect outbreaks, dense, low cover for hiding and security in shrub oak, fresh sprouts, nectar, rich soil resources, such as earthworms.

Other stands have the following additional physiognomic type characteristics (Shrub oak - Rock outcrop):

- high numbers of bedrock and rock crevices and burrows
- thermal and visual security bedding, escape terrain
- seeds and grasshoppers
- high numbers of perches and loose bark occurrences

Symphoricarpos albus (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by Coast deer and other grazing animals. *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided hummingbird, Anna's hummingbird, probably serves for butterflies, and is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling.

Aesthetic / Recreational: Overall aesthetic appeal is rated as very high, especially

because of the spring flower show provided by this community. The rating is also based on the following:

- mostly very high, with some low, by physiognomic type
- low by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Camassia leichtlinii (great camas) has cultural heritage significance for its use as an edible bulb by aboriginal people. *Symphoricarpos albus* (snowberry) adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: high to very high

Restoration Potential: very high

Restoration Priority: very high

Special Management:

Consideration should be given to *Camassia leichtlinii* (great camas) which has yellow (potentially vulnerable) status. Great camas is cultivated and used in native plant gardening.

c48 Oak - *Montia perfoliata*

Ecosystem Description:

Frequency of Occurrence: 12 plots, frequent

Distribution: From Plots: Saltspring Island: Mt. Maxwell; Saanich Peninsula: Mt. Finlayson, Mt. Doug., Uplands, Glendale Lands, Thetis Lk. Pk.; western shore: Juan de Fuca Pk., Colwood DND, Rocky Pt. From Notes: Naden Hill

Plant Community Description: *Montia perfoliata* (perfoliate-leaved miners lettuce) is present on all sites and averages class 3 cover. The remaining species occur on most sites. *Cytisus scoparius* (introduced broom) and *Galium aparine* (cleavers) average

cover class 3. *Elymus glaucus* (blue wildrye), *Bromus sterilis* (introduced barren barngrass), *Poa pratensis* (introduced Kentucky bluegrass), *Sanicula crassicaulis* (Pacific snakeroot), *Camassia leichtlinii* (great camas), and *Stellaria media* (introduced chickweed) average cover class 2. *Bromus carinatus* (California brome) averages cover class 1 to 2.

Tree Canopy/ Landscape Expression: either tree canopy (A) layer (6), or tall shrub canopy (B1) layer

Oak Characteristics: Diameters: mostly small (10); Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Stocking for saplings averages lightly- to moderately well-stocked. Stocking for seedlings averages moderately well-stocked.

Physiognomic Type: various: some Shrub Oak - Basin Broomland (4) and Oak - Light Shrub - Herb - Bulb Parkland (2). Suggested Successional Status: chiefly Mature Edaphic Climax and Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.40 Adjusted Motyka Comparison: 0.71 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (C51); 0.68 Oak - *Camassia leichtlinii* (early-season) (C36); 0.19 Oak - *Camassia quamash*: Typic (early-season) (c37a).

Elevation: low to high elevation Slope: gentle to steep

Aspect: various Surface Shape: various: concave (5), straight (3)

Moisture Regime: mainly subxeric to permesic (very xeric)

Exposure: insolation, wind Bedrock Geology: primarily coarse: granitic, gneiss

Surface Substrate Features: most plots (9) have either moderate to very high (class 3 to 6) bedrock exposure (6) or moderate to high surface rocks (class 3 to 5) (6)

Soil Classification: generally Orthic Sombric Brunisols, some Regosols (2)

Humus Classification: Vermimulls (6) and Rhizomulls (5)

Depth of Ah Horizon: usually > 25 to 35 cm (8), or some 0 to 25 cm

Colour of Ah Horizon: dark, 10YR2/1

Depth to Bedrock: mostly without (9), some with bedrock at 4 to 25 cm (3)

Surface Soil Texture: sandy loam to silt loam, some gravelly and very gravelly (6)

Percent Coarse Fragments: some high coarse fragments (4)

Comments: This plant community is probably not as visually obvious as the others. It was not directly recognized as a community in the field work, instead being derived from later reflection and review of the data.

Discussion:

Presence of deep *Ah* horizons may be a feature which partly distinguishes this community. It could be derived from the other early-season plant communities, such as c37a or b, and c36 through the depletion of bulbs by grazing, mowing or recreational impact.

There are no types classified for these species in the literature on oak woodlands. *Montia perfoliata* was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). There is a discussion of *Camassia leichtlinii* in c36.

Interpretations:

Preservation Priority: high by general ranking.

Regeneration: Regeneration potential is moderate. Seedlings present on all sites and moderately well-stocked (above average). Seedlings normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Shrub oak- Basin- Broomland) to which this plant community has been assigned:

- potential for the occurrence of chaparral bird species
- increased food for foliage gleaners due to relatively more insect outbreaks, dense, low cover for hiding and security in shrub oak
- browse and seeds for wildlife, and dense security and hiding cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all provided by broom
- rich soil resources, such as earthworms, nectar, high numbers of small dead limbs

Some stands have the following physiognomic type characteristics (Oak- Light Shrub Cover- Herb - Bulb Parkland):

- thermal bedding and foraging on moderate to moderately steep south to west slopes and bedrock or rock exposure
- fresh sprouts, foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- some trees with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Camas is heavily preferred as fresh sprouts in spring by deer and other grazing animals. *Sanicula crassicaulis* (Pacific snakeroot) is also used. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational:

Overall, aesthetic appeal is rated as low to moderate, based on the following:

- low by physiognomic type, with some very high

- mostly low by oak diameter (size class)
- low (to high) by oak form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type.

Camassia leichtlinii (great camas), present in moderate amounts, gives early-season appeal with its flowering and interest value with its seed heads. Camas has cultural heritage value for its historic aboriginal food use, *Galium aparine* (cleavers) for its technological use. *Montia perfoliata* (perfoliate-leaved miners lettuce) and *Stellaria media* (introduced chickweed) could be eaten for enjoyment on unpolluted sites.

Susceptibility to Disturbance: moderately high

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: high

Restoration Potential: very high

Restoration Priority: high

c51 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity

Ecosystem Description:

Frequency of Occurrence: 3 plots, infrequent

Distribution: From Plots: Saanich Peninsula: Thetis Lk. Pk.; western shore: Colwood DND, Pedder Bay. From Notes: Nanaimo: Harewood Plains; Glendale Lands

Plant Community Description: *Dicranum scoparium* (broom moss) is present on all sites and averages class 2 to 3 cover. *Plectritis congesta* (seablush) thrives on all sites and averages class 3 cover.

Camassia leichtlinii (great camas), *Montia perfoliata* (perfoliate-leaved miners lettuce), and *Rhytidiadelphus triquetrus* (electrified cat's-tail moss) occur on all sites and average class 3 cover. *Galium aparine* (cleavers) occupies all sites and averages class 2 to 3 cover. *Cytisus scoparius* (introduced broom), *Anthoxanthum odoratum* (introduced sweet vernalgrass), *Sanicula crassicaulis* (Pacific snakeroot), and *Sedum spathulifolium* (broad-leaved stonecrop) exist on all sites and average class 2 cover. *Symphoricarpos albus* (snowberry), *Rubus ursinus* (trailing blackberry), and *Osmorhiza*

chilensis (sweet cicely) are present on all sites and average class 1.

The remaining species are present on most sites. *Holodiscus discolor* (oceanspray), *Bromus carinatus* (California brome grass), *Melica subulata* (onion grass), *Poa pratensis* (introduced Kentucky bluegrass), *Dactylis glomerata* (introduced orchard grass), *Festuca bromoides* (introduced annual fescue), and *Montia parvifolia* (small-leaved montia) average cover class 2. *Elymus glaucus* (blue wildrye), *Bromus mollis* (introduced soft brome grass), *Bromus sterilis* (introduced barren barn grass), *Heuchera micrantha* (small-flowered alumroot), *Cerastium arvense* (field chickweed), *Polystichum munitum* (swordfern), *Delphinium menziesii* (Menzies' larkspur), *Erythronium oregonum* (easter lily), *Vicia americana* (American vetch), *Collinsia parviflora* (small-flowered blue-eyed Mary), *Geranium molle* (introduced dovefoot geranium), *Vicia hirsuta* (introduced hairy vetch), *Vicia sativa* (introduced common vetch), and *Stellaria media* (introduced chickweed) average cover class 1.

Tree Canopy/ Landscape Expression: tree canopy (A) layer

Oak Characteristics: Diameters: various, 25.3 to 42.9 cm;

Regeneration: Regeneration is occurring on most sites for saplings and on all sites for seedlings. Sapling stocking averages moderately well-stocked. Seedling stocking averages light.

Physiognomic Type: usually Oak - Light Shrub - Herb - Rockland (2).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.83 Adjusted Motyka Comparison: 0.71 Oak - *Montia perfoliata* (early-season) (C48); 0.68 Oak - *Camassia leichtlinii* (early-season) (C36); 0.29 Oak- *Dicranum scoparium*- *Sedum spathulifolium* subcommunity (c45); 0.25 Oak- *Dicranum scoparium*: Typic (c52); 0.19 Oak- *Camassia quamash*: Typic (c37a).

Elevation: low to mid-elevation (55 to 80 m) Slope: steep (45 to 75 %)

Aspect: north and east Surface Shape: convex

Moisture Regime: usually xeric to very xeric (also permesic on rubble with seepage)

Exposure: generally without Bedrock Geology: granitic (2), basalt (1)

Surface Substrate Features: all plots have high to very high (class 4 to 6) bedrock

exposure

Soil Classification: Orthic Humic Regosols (2), Orthic Sombric Brunisols (1)

Humus Classification: Vermimulls Depth of Ah Horizon: > 10 to 30 cm

Colour of Ah Horizon: dark, 10YR2/1 Depth to Bedrock: 15 cm (estimated) to 40 cm (estimated)

Surface Soil Texture: silt loam (2) or loam (1), usually very gravelly (2) or gravelly (1) Percent Coarse Fragments: usually high (2) (60 to 90 %)

Comments: This plant community is one of the showy flower meadows for which the Garry oak habitat is famous in spring. With only three plots, this characterization can only be considered tentative.

Discussion:

This subcommunity is partly distinguished by shallowness to bedrock and occurrence on northerly-facing slopes. Its association with fine textured soils-- loam to silt loam-- and deep *Ah* horizons may further separate from related communities. Successional derivations were not detectable for this community.

There are no types classified for these species in the literature on oak woodlands. Two biogeocoenoses were recognized partly for *Dicranum*, *Camassia* and *Quercus* by Krajina (1969). *Plectritis congesta* was in the dominant species-combination of the *Quercus-Erythronium-Montia* subassociation of Roemer (1972). *Heuchera micrantha* was also thus assigned and was a constant, but minor species in c51. *Plectritis congesta* is mentioned for Gabriola Island in the description of "shallow soils and open tree canopy" with Garry oak by Oswald (1977). *Collinsia grandiflora*, not *C. parviflora* as in c51, was present. *Plectritis congesta* was among the characteristic species of the oak woodland association for the area north of the Siskiyou described by Stoutamire (1951). There is a discussion of *Dicranum scoparium* in c52, camas (*Camassia* spp.) in c37a and c36, *Sedum spathulifolium* in c45 and *Erythronium oregonum* in c35a.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately high. Seedlings present on all sites. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Light Shrub- Herb- Rockland) to which this plant community has been assigned:

- high numbers of utilization detections, high number of bird species records, high numbers of bedrock to bedrock and rock crevice features, fresh sprouts, foraging space, and nectar.

This community also has some trees with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Camas is heavily preferred as fresh sprouts in spring by deer and other grazing animals. *Rubus ursinus* (trailing blackberry), present in small amounts in this community, is of high importance as winter forage for Coast deer. *Holodiscus discolor* (oceanspray) is both moderate in cover and importance as winter forage for Coast deer. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by Coast deer and other grazing animals. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker

(*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling.

Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sara orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). Moss elfin (*Incisalia mossii*), a blue-listed butterfly, depends on *Sedum spathulifolium* (broad-leaved stonecrop) in its caterpillar stage. Brown elfin (*Incisalia augustinus*) larvae probably also use this stonecrop, which is present in modest amounts. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*) and, together with *Delphinium menziesii* (Menzies' larkspur), is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. *Holodiscus discolor* (oceanspray) is a larval food for spring azure (*Celastrina ladon*) and Lorquin's admiral (*Basilarchia lorquini*) butterflies, and the brightly coloured sheep moth (*Hemileuca eglantheria*). The ability of *Melica subulata* (oniongrass) to stay green into the summer may provide suitable rearing conditions for the two generations of ringlet butterflies (*Coenonympha tullia insulana*), a vulnerable status species. *Vicia americana* (American vetch) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), western tailed blue (*Everes amyntula*), and the endangered greenish blue (*Plebejus saepiolus insulanus*), all of which use *Vicia*. So also would western sulphur (*Colias occidentalis occidentalis*), were this butterfly not extirpated from the Garry oak areas. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as very high, especially because of the spring flower show provided by this community. The rating is also based on the following:

- mostly very high, by physiognomic type

- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Although present in small amounts, *Symphoricarpos albus* (snowberry) adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. The flowering of species such as *Sedum spathulifolium* (broad-leaved stonecrop), *Heuchera micrantha* (small-flowered alumroot), *Cerastium arvense* (field chickweed), *Delphinium menziesii* (Menzies' larkspur), *Erythronium oregonum* (easter lily), *Vicia americana* (American vetch) and *Collinsia parviflora* (small-flowered blue-eyed Mary), although present in small amounts, add to the aesthetic and interest value of this community. *Heuchera micrantha* (small-flowered alumroot) adds appeal by staying green into the summer. *Montia perfoliata* (perfoliate-leaved miners lettuce) and *Stellaria media* (introduced chickweed) could be eaten for enjoyment on unpolluted sites. This plant community is often on hilltops which are the destination of hikers, birders and naturalists and can provide a cool rest stop because of its occurrence on north and east slopes.

Camassia leichtlinii (great camas) has cultural heritage significance for its use as an edible bulb by aboriginal people, *Galium aparine* (cleavers) for its technological use, *Heuchera micrantha* (small-flowered alumroot) for its medicinal use and *Rubus ursinus* (trailing blackberry) for its food, medicinal and spiritual use and mythological importance.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is low and often not advisable.

Threats: high

Restoration Potential: moderately high

Restoration Priority: moderately high

Special Management:

Any burning plans should consider the conflict with populations of western tailed

blue (*Everes amyntula*), which winter in *Lathyrus* and *Vicia* seedpods. *Heuchera micrantha* (small-flowered alumroot) is cultivated and used in native plant gardening.

c11 Oak - *Dicranum scoparium* - *Montia parvifolia* subcommunity

Ecosystem Description:

Frequency of Occurrence: 7 plots, infrequent

Distribution: From Plots: Duncan to Nanaimo: Harewood Plains, Priest Pt.; Saanich Peninsula: Water Tower Hill, Glendale Lands, Thetis Lk. Pk.; western shore: Colwood DND, Rocky Pt. From Notes: Saltspring Is.: Channel Ridge; Saanich Peninsula: Gore Pk., Observatory Hill.

Plant Community Description: *Dicranum scoparium* (broom moss) is present on most sites and averages class 3 cover. *Montia parvifolia* (small-flowered montia) occupies all sites and averages class 3 to 4 cover. *Elymus glaucus* (blue wildrye) and *Galium aparine* (cleavers) grow on all sites and average class 2 to 3 cover. The remaining species occur on most sites. *Anthoxanthum odoratum* (introduced sweet vernalgrass), *Montia perfoliata* (perfoliate-leaved miners lettuce) and *Rhytidiadelphus triquetrus* (electrified cat's-tail moss) average class 3 cover. *Symphoricarpos albus* (snowberry), *Aira caryophyllea* (silver hairgrass), and *Polystichum munitum* (swordfern) average cover class 2. *Bromus carinatus* (California brome grass) averages cover class 1 to 2. Tree Canopy/ Landscape Expression: usually tall shrub canopy (B1) layer, some tree canopy (A) layer

Oak Characteristics: Diameters: small diameter; Regeneration: Regeneration is occurring on some sites for saplings and most sites for seedlings. Stocking averages moderately well-stocked for saplings and lightly-stocked for seedlings.

Physiognomic Type: usually Shrub Oak - Rock Outcrop (3) or Oak - Light Shrub - Herb - Bulb - Parkland (2).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.58 Adjusted Motyka Comparison: 0.80 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (C51); 0.60 Oak- *Dicranum scoparium*:

Typic subcommunity (c52); 0.42 Oak- *Dicranum scoparium*- *Sedum spathulifolium* subcommunity (c45).

Elevation: primarily low and medium elevation Slope: usually steep to moderately steep

Aspect: west (north) east Surface Shape: various

Moisture Regime: xeric to very xeric Exposure: insolation (5), some wind (2)

Bedrock Geology: coarse: conglomerate, granitic gneiss

Surface Substrate Features: all plots have moderate to very high bedrock exposure (class 3 to 6). Most plots (4) have moderate to high (class 3 to 5) surface rocks

Soil Classification: usually Orthic Regosols Humus Classification: usually Rhizomulls (5) Depth of Ah Horizon: mainly very shallow, 3 to 6 cm,

Colour of Ah Horizon: dark, 10YR2/1

Depth to Bedrock: usually very shallow, 2 to 6 cm (6)

Surface Soil Texture: usually silt loam (4+)

Percent Coarse Fragments: none to low, 0 to 40 %

Comments: related in a general way to the Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza* plant community (c15).

Discussion:

This subcommunity is distinguished by its residence on northerly- facing slopes, and partly by the silt loam texture of the shallow *Ah*. With disturbance it might convert into c48.

Montia parvifolia was recognized in the *Quercus-Erythronium-Montia* subassociation of Roemer (1972). The other important species of c11 were not in Roemer's dominant species-combination.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately low. Saplings present on all sites.

Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Shrub oak- Rock Outcrop) to which this plant community has been assigned:

- indications of high utilization, high average numbers of wildlife use and wildlife habitat attributes, high numbers of bedrock and rock crevices and burrows.
- potential for attracting chaparral species
- increased food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- visual security and some thermal bedding, escape terrain, fresh sprouts, seeds, nectar, grasshoppers
- high total numbers of tree wildlife habitat features, high numbers of perches, loose bark occurrences, scaling limbs, small and medium dead limbs.

Symphoricarpos albus (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sarah orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling. Snowberry is the larval food of the snowberry bee

hawk moth (*Hemaris diffinis*). *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- high with some very high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

The flowering of *Montia parvifolia* (small-flowered montia) adds interest value to this community. *Symphoricarpos albus* (snowberry) adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Polystichum munitum* (swordfern) provides interest value as evergreen winter cover. Swordfern has cultural heritage value for its historic aboriginal use as food and in domestic technology. *Montia perfoliata* (perfoliate-leaved miners lettuce) is edible, and could be eaten for enjoyment on unpolluted sites. This plant community is often on hilltops which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is low and often not advisable.

Threats: high

Restoration Potential: moderately high

Restoration Priority: moderately high

Special Management: Tree protection devices or other measures may be required against deer browsing if adequate regeneration is to be achieved. *Polystichum munitum* (swordfern) is cultivated and used in native plant gardening.

c45 Oak - *Dicranum scoparium* - *Sedum spathulifolium* subcommunity

Ecosystem Description:

Frequency of Occurrence: 5 plots, infrequent

Distribution: From Plots: Duncan - Nanaimo: Jack Pt., Yellow Pt.: Flewitt Pt.; Saanich Peninsula: Glendale Lands, Thetis Lk.; western shore: East Sooke.

From Notes: Nanaimo: Neck Pt., Harewood Plains, Joan Pt.; Galiano Is.: Mt. Galiano, Bellhouse Pk.; Saanich Peninsula: Naden Hill, Woodsend Dr.; western shore: Pedder Bay, Mary Hill, Rocky Pt.

Plant Community Description: *Dicranum scoparium* (broom moss) is present on most sites and averages cover class 3. *Sedum spathulifolium* (broad-leaved stonecrop) thrives on all sites and averages cover class 3. *Symphoricarpos albus* (snowberry) occupies all sites and averages class 2 to 3 cover. *Galium aparine* (cleavers) occurs on most sites and averages class 1 to 2 cover.

Tree Canopy/ Landscape Expression: tall shrub (B1) canopy layer

Oak Characteristics: Diameters: small diameter; Regeneration: Regeneration is occurring on all sites for saplings and most sites for seedlings. Saplings average well-stocked. Seedlings average lightly- to moderately well-stocked.

Physiognomic Type: Shrub Oak - Rock Outcrop

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.34 Adjusted Motyka Comparison: 0.42 Oak - *Dicranum scoparium* - *Montia parvifolia* - subcommunity (c11); 0.29 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (c51).

Elevation: low to medium Slope: moderate to very steep

Aspect: chiefly southeast to west-southwest

Surface Shape: mostly convex (4), one is variable

Moisture Regime: xeric to very xeric Exposure: insolation, wind (3)

Bedrock Geology: usually coarse: granitic, gneiss, sandstone (4)

Surface Substrate Features: all plots have moderate to very high (class 3 to 6) bedrock exposure and some plots (2) have high (class 4 or 5) surface rocks

Soil Classification: Regosols Humus Classification: various

Depth of Ah Horizon: (0) 4 to 20 cm Colour of Ah Horizon: generally dark, 10YR2/1 Depth to Bedrock: shallow, 4 to 20 cm

Surface Soil Texture: sandy loam to silt loam, often gravelly (3)

Percent Coarse Fragments: often high (70 to 93 %) (3)

Comments: one plot representative from Saltspring Island was allocated elsewhere, to c4 Oak - Broom - *Poa pratensis*.

Discussion:

This subcommunity is partly distinguished by its high coarse fragments, sharing other features with c46 and c52, and by its occurrence on southerly-facing slopes, sharing other features with c51 and c11. With disturbance it might convert into c48 or c52.

There are no types classified for these species in the literature on oak woodlands. *Sedum spathulifolium* was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972) and was among the characteristic species of the oak woodland association for the area north of the Siskiyou described by Stoutamire (1951). There is a discussion of *Dicranum scoparium* in c52 and *Symphoricarpos albus* in c15.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is high. Saplings present on all sites and well-stocked. Seedlings lightly- to moderately well-stocked (above average).

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Shrub oak- Rock Outcrop) to which this plant community has been assigned:

- indications of high utilization, high average numbers of wildlife use and wildlife habitat attributes, high numbers of bedrock and rock crevices and burrows.
- potential for attracting chaparral species
- increased food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak

- thermal and visual security bedding, escape terrain, fresh sprouts, seeds, nectar, grasshoppers
- high total numbers of tree wildlife habitat features, high numbers of: perches, loose bark occurrences, scaling limbs, small and medium dead limbs.

Sedum spathulifolium (broad-leaved stonecrop) is stripped off these mossy rocks by deer foraging. It is therefore a food resource, but a sensitive one. Consequently, the absence of this community from many Gulf Islands is attributed to deer grazing pressure. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling.

Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sara orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). Moss elfin (*Incisalia mossii*), a blue-listed butterfly, depends on *Sedum spathulifolium* (broad-leaved stonecrop) in its caterpillar stage. Brown elfin (*Incislia augustinus*) larvae probably also use this stonecrop. *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- high with some very high by physiognomic type

- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Sedum spathulifolium (broad-leaved stonecrop) adds to the appeal of this community, especially as it has a longer, later flowering period than many other species of Garry oak habitats. *Symphoricarpos albus* (snowberry) adds to aesthetic appeal with its delicate early spring leaves, flowering and showy white berries persisting into winter. *Sedum spathulifolium* (broad-leaved stonecrop) has cultural heritage value for its historic aboriginal medicinal use. This plant community is often on hilltops which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is low and often not advisable.

Threats: high

Restoration Potential: moderately high

Restoration Priority: moderately high

Special Management: *Sedum spathulifolium* (broad-leaved stonecrop) is cultivated as a rock garden plant.

c52 Oak- *Dicranum scoparium*: Typic subcommunity

Ecosystem description:

Frequency of Occurrence: 4 plots, infrequent

Distribution: From Plots: widely distributed: Nanoose Bay: Dolphin Hill; Nanaimo: Jack Pt.; Fort Rodd Hill, Portland Island, not on main Gulf Islands though

From Notes: Summit Pk.

Plant Community Description: *Dicranum scoparium* (broom moss) is present on all sites and averages class 3 to 4 cover. The remaining species are present on most sites. *Festuca bromoides* (introduced annual fescue) averages class 3 cover. *Anthoxanthum odoratum* (introduced sweet vernalgrass) and *Rhacomitrium canescens* (gray frayed-

cap moss) average class 2 to 3 cover. *Symphoricarpos albus* (snowberry), *Lonicera hispidula* (hairy honeysuckle), and *Elymus glaucus* (blue wildrye) average cover class 2. *Festuca idahoensis* (Idaho fescue) and *Lotus micranthus* (small-flowered lotus) average cover class 1 to 2. *Galium aparine* (cleavers) averages cover class 1.

Tree Canopy/ Landscape Expression: most have a tree canopy (A) layer

Oak Characteristics: Diameters: 21.7 to 29.3 cm;

Regeneration: Regeneration is occurring on all sites for saplings and on some sites for seedlings. Stocking of saplings averages moderately well-stocked. Seedling stocking averages light.

Physiognomic Type: various

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.50 Adjusted Motyka Comparison: 0.60 Oak - *Dicranum scoparium* - *Montia parvifolia* - subcommunity (c11); 0.25 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (C51).

Elevation: low to high Slope: primarily gentle (3), one steep

Aspect: east-southeast to west Surface Shape: convex (2) and various

Moisture Regime: about subxeric to very xeric

Exposure: insolation, wind (3) Bedrock Geology: mainly coarse: sandstone (2), granitic (1); slate (1)

Surface Substrate Features: all plots have moderate to high (class 3 to 5) bedrock exposure, some plots (2) have moderately high (class 3) surface rocks

Soil Classification: Orthic Sombric Brunisols, Regosols

Humus Classification: Rhizomulls (2)

Depth of Ah Horizon: 3 to > 25 cm Colour of Ah Horizon: dark, 10YR2/1, 2/1.5 (3) Depth to Bedrock: 3 to 50 cm (estimated) Surface Soil Texture: sandy loam to silt loam, chiefly gravelly, one very gravelly Percent Coarse Fragments: mostly low to medium (20 to 40 %), one is high (80 to 95 %)

Discussion:

Occurrence on sites with convex surface shapes partly distinguishes this subcommunity, which shares other features with c45 and c46. On some sites its occurrence may be derived from c45 through the depletion of forbs by disturbance.

There are no types classified for these species in the literature on oak woodlands. *Dicranum scoparium* was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). There is a discussion of *Festuca bromoides* in c50.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately low. Saplings present on all sites. Seedlings only present on some sites. Stocking normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Shrub oak- Rock Outcrop) to which this plant community has been assigned:

- indications of high utilization, high average numbers of wildlife use and wildlife habitat attributes, high numbers of bedrock and rock crevices and burrows.
- potential for attracting chaparral species
- increased food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- thermal and visual security bedding, escape terrain, fresh sprouts, seeds, nectar, grasshoppers
- high total numbers of tree wildlife habitat features, high numbers of: perches, loose bark occurrences, scaling limbs, small and medium dead limbs.

Symphoricarpos albus (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk

(*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling. Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sara orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). *Lonicera hispidula* and *Symphoricarpos albus* (snowberry) are noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Lotus micranthus* (small-flowered lotus) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), which uses *Lotus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- high with some very high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Symphoricarpos albus (snowberry) adds to aesthetic appeal with its delicate early spring leaves, flowering and showy white berries persisting into winter. *Lonicera hispidula* (hairy honeysuckle) has showy flowers which attract colourful hummingbirds and probably butterflies. This plant community is often on hilltops which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is low and often not advisable.

Threats: high

Restoration Potential: high

Restoration Priority: moderate

Special Management: Tree protection devices or other measures may be required against deer browsing if adequate regeneration is to be achieved. *Lotus micranthus* (small-flowered lotus), present in small to moderate quantities, is important for its ability to fix atmospheric nitrogen. Consideration should also be given to this species for its yellow (potentially vulnerable) status.

c46 Oak - (Fd) - *Rhacomitrium canescens* - *Selaginella wallacei* subcommunity

Ecosystem Description:

Frequency of Occurrence: 4 plots, infrequent

Distribution: From Plots: Duncan: Genoa Bay; southern Gulf Islands: Galiano Is.: Bodega Ridge, Salalikim Rock; Mayne Island: Mt. Parke From Notes: Nanoose Bay: Dolphin Hill; Galiano Is.: Bluffs Pk.; Tumbo Is.; Pender Is.: Oak Bluffs; Portland Is.; Saltspring Is.: Mt. Maxwell; Saanich Peninsula: Gore Pk., Mt. Work, Woodsend Dr.; western shore: Rocky Pt.

Plant Community Description: *Rhacomitrium canescens* (gray frayed-cap moss) is present on all sites and averages class 3 to 4 cover. *Selaginella wallacei* (Wallace's selaginella) occurs on all sites and averages class 3 cover.

Bromus carinatus (California brome) and *Elymus glaucus* (blue wildrye) grow on all sites and average cover class 2 and 1 to 2, respectively. The remaining species exist on most sites. *Polytrichum juniperinum* (juniper haircap moss) averages class 2 to 3 cover. *Luzula multiflora* (many-flowered woodrush) and *Festuca bromoides* (introduced annual fescue) average cover class 2. *Achillea millefolium* (yarrow), *Lotus micranthus* (small-flowered lotus), and *Collinsia parviflora* (small-flowered blue-eyed Mary) average cover class 1 to 2. *Eriophyllum lanatum* (woolly sunflowers), *Aira praecox* (early hairgrass), *Crepis cf. modocensis* (modoc hawkweed), *Rumex acetosella* (introduced hairy cats ear), and *Pityrogramma triangularis* (goldback fern) average cover class 1.

Tree Canopy/ Landscape Expression: Oak: tree canopy (A) layer (2), or tall shrub (B1) canopy layer (2). Douglas-fir (Fd, *Pseudotsuga menziesii*) is present on most sites in the tree canopy (A) layer, and averages class 2 to 3 cover. There are also some sites with Douglas-fir in the tall shrub (B1) layer, which averages class 2 cover.

Oak Characteristics: Diameters: various; Regeneration: Regeneration is occurring on most sites for saplings and all sites for seedlings. Stocking for both saplings and seedlings averages moderately well-stocked.

Physiognomic Type: various rockland and rock outcrop types.

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.51 Adjusted Motyka Comparison: 0.87 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity (c50); 0.86 Oak - Broom - *Rhacomitrium canescens*: Typic (c17); 0.24 Oak- *Cynosurus echinatus* (c21);

Elevation: usually high elevation

Slope: generally very steep (65 to 115 %), one moderate slope

Aspect: south to west Surface Shape: some are convex (2)

Moisture Regime: usually very xeric (3) Exposure: insolation, wind

Bedrock Geology: coarse: conglomerate, sandstone

Surface Substrate Features: all plots have high or very high (class 4 to 6) bedrock exposure Soil Classification: Orthic Regosols (2), or Orthic Dystric Brunisols (2)

Humus Classification: some Orthi Rhizomulls (2)

Depth of Ah Horizon: 5 to 30 cm (estimated)

Colour of Ah Horizon: dark, 10YR2/1.5, or dark and slightly brownish

Depth to Bedrock: 5 to 50 cm (estimated)

Surface Soil Texture: sandy loam to loam, gravelly to very gravelly

Percent Coarse Fragments: usually high (60 to 70 %)

Comments: These are the most xeric plots in the entire survey.

Discussion:

This subcommunity is probably distinguished by very high bedrock exposure and high-elevation occurrence on very steep, convex, south- and west- facing slopes.

It is thought to be the original one for a number of derived communities: c3 via c50; c17, and c22.

Quercus garryana-Rhacomitrium canescens communities have been described for the Saanich Peninsula (Szcawinski and Harrison, 1973). *Quercus garryana-Rhacomitrium* communities have been identified for Galiano and smaller islands (Pattison and Karanka, 1981), Saturna and Mayne Islands (Janszen, 1977; 1981). Similar communities on the Mt. Tuam Ecological Reserve were named for *R. heterostichum* (Taylor and Brayshaw, 1978). Two biogeocoenoses were recognized partly for *Rhacomitrium* and *Quercus* by Krajina (1969). *Rhacomitrium canescens* was typical of exposed bedrock areas with Garry oak on the Shallow Soil landscape unit described from Gabriola Island by Oswald (1977). *Achillea millefolium*, constant in c46, was present in a sparse cover. Both a grassland / moss (*Rhacomitrium canescens*) community and a *Pseudotsuga menziesii* / moss (*Rhacomitrium canescens*) woodland were associated with oak on Pt. Disney, Waldron Island, Washington (Salstrom, 1989). *Selaginella wallacei* was present on some plots with substantial cover. Both *Rhacomitrium canescens* var. *ericoides* and *Selaginella wallacei* are associated with *Acer circinatum* and *Acer macrophyllum* on nonforested talus slopes in the Pacific Northwest (Franklin and Dyrness, 1973).

Rhacomitrium canescens var. *ericoides* forms part of large thick non-vascular mats on the Mima Mounds and Baker prairies (Chehalis Habitat Inventory Team, 1980; Dickey, 1992; Kavanaugh, 1992; pers. obs.). *Rhacomitrium canescens* was abundant on the non-oak *Festuca idahoensis* grassland on Sucia Island, Washington (Fonda and Bernardi, 1976). *Rhacomitrium canescens* var. *ericoides* is the typical dominant of a "moss meadow" type occurring in nonforested areas in the Mixed-Conifer Zone described by Franklin and Dyrness (1973).

Selaginella wallacei and *Lotus micranthus* were important species in the *Quercus-Geranium (QG) Lomatium* subassociation of Roemer (1972), as they are in c46. *Luzula multiflora* was among a group of high constancy or dominance species not used for taxonomic purposes by Roemer (1972).

Eriophyllum lanatum, constant in c46, was noted in the understory of one *Quercus garryana* plant community described by Keeler-Wolf (1990) from the Soldier Research Natural Area, north fork of the Eel River, northern California: *Rumex acetosella*, *Achillea millefolium* and *Lotus micranthus* were included on the non-differentiating species list from the *Viola adunca* provisional association of Aldrich (1972), from the Oregon "balds", a non-oak area. Each was a constant species in c46. There is a discussion of *Aira praecox* in c50.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is high. Seedlings present on all sites and moderately well-stocked (above average). Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Shrub oak- Rock Outcrop) to which this plant community has been assigned:

- indications of high utilization, high average numbers of wildlife use and wildlife habitat attributes, high numbers of bedrock and rock crevices and burrows.
- potential for attracting chaparral species
- increased food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak, thermal and visual security bedding, escape terrain, fresh sprouts, seeds, nectar, grasshoppers
- high total numbers of tree wildlife habitat features, high numbers of: perches, loose bark occurrences, scaling limbs, small and medium dead limbs.
- some trees with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

The rocky, warm environment of this community provides habitat opportunities for deer, snakes and northern alligator lizards (*Gerrhonotus coeruleus*). The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*) as they would formerly have been for western bluebirds (*Sialia mexicana*).

Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling. Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sarah orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). *Lotus micranthus* (small-flowered lotus) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*) which uses *Lotus*. Composites such as *Achillea millefolium* (yarrow) and *Eriophyllum lanatum* (woolly sunflower) provide nectar for butterflies such as silvery blue (*Glaucopsyche lygadamus*), mylitta crescent spot (*Phycoides mylitta*) and painted ladies (*Vanessa cardui*, *V. annabella*). *Bromus carinatus* (California brome grass) may be the larval

food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- high, with some very high, by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Selaginella wallacei (Wallace's selaginella) and *Achillea millefolium* (yarrow) enhance later-season aesthetics by remaining green into the summer. *Achillea millefolium* (yarrow), *Collinsia parviflora* (small-flowered blue-eyed Mary), *Eriophyllum lanatum* (woolly sunflowers) and *Pityrogramma triangularis* (goldback fern), present in small to moderate quantities, add appeal and interest value with their flowers, foliage or both. *Achillea millefolium* (yarrow) has cultural heritage value for its historic aboriginal medicinal use. This plant community is often on hilltops which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is low and often not advisable.

Threats: moderately high

Restoration Potential: moderately high

Restoration Priority: high

Special Management: Silviculture treatments should be applied to control Douglas-fir encroachment. Girdling or removal of individual fir trees and patches of shrubs will be beneficial to the maintenance of this plant community. *Lotus micranthus* (small-flowered lotus), present in moderate quantities, is important for its ability to fix atmospheric nitrogen. Consideration should also be given to this species for its yellow (potentially vulnerable) status, along with *Pityrogramma triangularis* (goldback fern). *Selaginella wallacei* (Wallace's selaginella), *Eriophyllum lanatum* (woolly sunflowers) and *Pityrogramma triangularis* (goldback fern) are cultivated and used in native plant

gardening.

c26 Oak - *Mahonia aquifolium*

Ecosystem Description:

Frequency of Occurrence: 4 plots, infrequent

Distribution: **From Plots:** Denman Island, Saanich Peninsula: Lone Tree Hill, Observatory Hill, Glendale Lands **From Notes:** Yellow Pt.: Boathouse Harbour n.;

Newcastle Island, Saanich Peninsula: Bear Hill, Thetis Lk. Pk., Naden Hill; Mill Hill

Plant Community Description: *Mahonia aquifolium* (tall Oregon grape) is present on all sites in the low shrub layer (B2), and averages class 3 to 4 cover. *Elymus glaucus* (blue wildrye), *Bromus carinatus* (California brome grass), *Vicia sativa* (introduced common vetch) and *Bromus sterilis* (introduced barren barngrass) are present on all sites and average class 2 cover. The remaining species occur on most sites. *Cynosurus echinatus* (introduced dogtail bristlegrass) averages class 2 to 3. *Achillea millefolium* (yarrow), *Cerastium arvense* (field chickweed), *Sanicula crassicaulis* (Pacific snakeroot), *Galium aparine* (cleavers), and *Vicia sativa* (introduced common vetch) average cover class 2. *Bromus carinatus* (California brome grass) averages cover class 1 to 2.

Tree Canopy/ Landscape Expression: usually tree canopy (A) layer (3)

Oak Characteristics: **Diameters:** small diameters, 17 to 28.4 cm;

Regeneration: Regeneration is occurring on all sites for both saplings and seedlings. Stocking is moderate for saplings and light to moderate for seedlings.

Physiognomic Type: various **Suggested Successional Status:** Mature Edaphic Climax, one might be a Maturing Seral stand.

Constant Cover Value: 0.50 **Adjusted Motyka Comparison:** 0.58 Oak - *Festuca idahoensis*: Typic subcommunity (c20) ; 0.55 Oak- *Bromus sterilis* (c23); 0.46 Oak- *Elymus glaucus* (c47); 0.43 Oak- *Lonicera hispidula* (c16a); 0.38 Oak- *Cynosurus echinatus* (c21).

Elevation: low to primarily high (2) elevation

Slope: usually steep, 25 to 70 % (3), one is gentle

Aspect: southwest to northwest Surface Shape: straight (3)

Moisture Regime: subxeric to xeric Exposure: usually insolation, wind

Bedrock Geology: various Surface Substrate Features: some plots (3) have either moderately high or high (class 3 to 5) bedrock exposure (2) or moderately high surface rock (2) Soil Classification: Orthic Sombric Brunisols

Humus Classification: Vermimulls, Xeromulls

Depth of Ah Horizon: some > 25 to 30 cm (2), 15 cm (1), no data (1)

Colour of Ah Horizon: dark and brownish, 10YR2/2 to 2.5/1.5 and 3.5/2

Depth to Bedrock: chiefly none (2), one at 30 cm, one estimated at 60 cm

Surface Soil Texture: mostly sandy loam to loam, some gravelly (2)

Percent Coarse Fragments: high subsurface coarse fragments (60 to 80+ %) (3)

Comments: Occurs on very rocky, colluvial talus sites.

Discussion:

Occurrence on more northerly slopes and very high surface coarse fragments partly distinguish this community. It may be one of the original communities from which c21 and c23 are derived.

Mahonia aquifolium was used to name an Edatopic Indicator Species Group (EISG 3.2) with *Quercus garryana* indicating very dry to dry, nutrient-medium to very rich sites in the Coastal Douglas-fir zone (Klinka et al., 1984a). *Mahonia aquifolium* was among the species from the *Quercus-Erythronium* (QE) of Roemer (1972) and is listed from a lowland xeric meadow from the central western Cascades of Oregon, which often supported scattered trees of *Quercus garryana* (Hickman, 1968).

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is very high. Sapling and seedling regeneration present on all sites. Seedlings are lightly- to moderately-stocked (above average).

Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Talus- Sparse Shrub- Herb- Parkland) to which this plant community has been assigned:

- highest average numbers of wildlife use and habitat features, seeds, foraging space, grasshoppers, fresh sprouts, nectar, rock crevices
- thermal south slopes, bedrock and rock exposure: bedding and foraging
- visual security bedding, escape terrain
- highest numbers of dead main stems

Other stands have the following additional physiognomic type characteristics (Oak- Grass- Rockland):

- indications of high utilization, high numbers of bedrock and rock crevices
- high total numbers of tree habitat features, high complexity of form in oak, high numbers of: perches, tree crevices/cavities, small dead limbs
- some trees have the following large tree attributes: bark glean, foliage glean, perching nesting, large dead limbs, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Mahonia aquifolium (tall Oregon grape) is moderately important as winter forage for Coast deer. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by deer and other grazing animals. Rockiness and exposure make this community habitat for snakes and northern alligator lizards (*Gerrhonotus coeruleus*). The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*) as they would formerly have been for western bluebirds (*Sialia mexicana*). Rockiness gives it the potential to support hibernacula for snakes. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow

(*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. Composites such as *Achillea millefolium* (yarrow) provide nectar for butterflies such as silvery blue (*Glaucopsyche lygadamus*), mylitta cresecent spot (*Phycoides mylitta*) and painted ladies (*Vanessa cardui*, *V.annabella*). *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low by oak diameter (size class)
- moderately high to high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Mahonia aquifolium (tall Oregon grape) adds appeal and interest value with its evergreen leaves, sometimes showy green, sometimes red; yellow, fragrant flowers and blue berries, which are also edible. Tall Oregon grape has cultural heritage value for its historic aboriginal food, technology, and medicinal use. *Achillea millefolium* (yarrow) and *Cerastium arvense* (field chickweed) add appeal and interest value to this community with their flowering and foliage. *Achillea millefolium* (yarrow) adds appeal by staying green into the summer. *Achillea millefolium* (yarrow) has cultural heritage value for its historic aboriginal medicinal use. This plant community is often near the top of hills which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is low.

Threats: moderately high

Restoration Potential: high

Restoration Priority: high

Special Management:

Tall Oregon grape has been cultivated for use as a rock garden plant.

c16a Oak - *Lonicera hispidula* (colluvial)Ecosystem Description:

Frequency of Occurrence: 9 plots, frequent in some areas

Distribution: From Plots: Duncan-Nanaimo: Nanoose Bay, Nanoose Hill, Yellow Pt.: Flewitt Pt.; Gulf Islands: Gabriola Is., Galiano Is.: Montague Harbour; Saturna Is.: East Pt.; Pender Is.: Hermit Hill; Saltspring Island: Reginald Hill

From Notes: Hornby Island, Yellow Pt.: s. of Roberts Memorial Pk., Kullet Bay; Galiano Is.: Bodega Ridge, Mt. Galiano, Salalikim Rock, Bellhouse Pk.; Mayne Island: Mt. Parke, Navy Channel; Pender Is.: Bedwell Harbour, Oak Bluffs; Saanich Peninsula: Bear Hill, Glendale Lands, Thetis Lk. Pk.; western shore: Mill Hill.

Plant Community Description: *Lonicera hispidula* (hairy honeysuckle) is present on all sites and averages class 4 cover. The remaining species occur on most sites. *Galium aparine* (cleavers) and *Vicia sativa* (introduced common vetch) average class 2 to 3. *Elymus glaucus* (blue wildrye), *Sanicula crassicaulis* (Pacific snakeroot), and *Vicia hirsuta* (introduced hairy vetch) average class 2 cover.

Tree Canopy/ Landscape Expression: tree canopy (A) layer (5), often high cover (class 5) (4), or tall shrub (B1) canopy layer

Oak Characteristics: Diameters: various; Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Saplings are well-stocked, on average, and seedlings are lightly- to moderately well-stocked.

Physiognomic Type: various: some Shrub Oak - Rock Outcrop (2), Oak - Grass Rockland (2), and Oak - Grass - Parkland (2).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.38 Adjusted Motyka Comparison: 0.76 Oak - *Festuca idahoensis*: Typic subcommunity (c20); 0.75 Oak - *Bromus sterilis* (c23); 0.08 Oak-*Elymus glaucus* (c47).

Elevation: usually low elevation, one is medium and two are high elevation

Slope: generally steep Aspect: south to southwest

Surface Shape: convex (4), straight (3), and others

Moisture Regime: submesic to xeric Exposure: insolation, wind, some seaspray (3)

Bedrock Geology: chiefly sandstone (5), and others

Surface Substrate Features: most plots (5) have either moderately high (class 3) exposed bedrock (3) or moderately high surface rocks (5).

Soil Classification: Orthic Sombric Brunisols (4) or Orthic Humic Regosols (4)

Humus Classification: Vermimulls (4), Orthi Rhizomulls (3), and others

Depth of Ah Horizon: 12 to 30 cm (4), or > 10 to 25 cm (4)

Colour of Ah Horizon: dark, 10YR2/1 (5), or dark and slightly brownish (3)

Depth to Bedrock: usually none, or 20 to 30 cm (4)

Surface Soil Texture: coarse: loamy-sand to sandy loam (6), usually gravelly to very gravelly (7) Percent Coarse Fragments: usually high subsurface coarse fragments (60 to 95 %) (6)

Comments: largely rocky colluvial, talus sites. This talus is stabilized and is below the surface, so is not reflected in the physiognomic type classification. This plant community is often found near the sea-edge.

Discussion:

This plant community is partly distinguished by its high surface coarse fragments, its relatively coarse soils: loamy sand to sandy loam, and its occurrence primarily at low elevations. It may be one of the original communities from which c23 is derived.

A Garry Oak - hairy honeysuckle – California fescue (oatgrass ?) vegetation unit was identified for Galiano and smaller islands by Pattison and Karanka (1981), for *Lonicera hispidula* and *Danthonia californica*. Salstrom (1989) classified a *Pseudotsuga menziesii*–*Quercus garryana* / *Lonicera hispidula* woodland from Pt. Disney, Waldron Island, Washington.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately high. Saplings are well-stocked. Seedlings are lightly- to moderately well- stocked (above average). Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Talus- Sparse Shrub- Herb- Parkland) to which this plant community has been assigned:

- highest average numbers of wildlife use and habitat features, seeds, foraging space, grasshoppers, fresh sprouts, nectar, rock crevices
- thermal south slopes, bedrock and rock exposure: bedding and foraging
- visual security bedding, escape terrain
- highest numbers of dead main stems

Other stand have the following additional physiognomic type characteristics (Oak- Grass- Rockland):

- indications of high utilization, high numbers of bedrock and rock crevices
- high total numbers of tree habitat features, high complexity of form in oak, high numbers of: perches, tree crevices/cavities, small dead limbs
- some trees have the following large tree attributes: bark glean, foliage glean, perching nesting, large dead limbs, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

The rockiness of the substrate of this community gives it the potential to support hibernacula for snakes. The community is also habitat for snakes and northern alligator lizards (*Gerrhonotus coeruleus*). The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*) as they would formerly have been for western bluebirds (*Sialia mexicana*). Seaside occurrences of this community should provide ideal habitat for the western garter snake (*Thamnophis elegans*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling;

common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. *Lonicera hispidula* is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low to high by oak diameter (size class)
- moderately high to high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Lonicera hispidula (hairy honeysuckle) has showy flowers which attract colourful hummingbirds and probably butterflies. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) provide some appeal and interest value with their flowers and pods.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is low.

Threats: high

Restoration Potential: high

Restoration Priority: moderately high

Special Management:

Consideration should be given to *Lonicera hispidula* (hairy honeysuckle), which has yellow (potentially vulnerable) status. Hairy honeysuckle is cultivated and used in native plant gardening.

c20 Oak - *Festuca idahoensis* Typic subcommunity

Ecosystem Description:

Frequency of Occurrence: 7 plots, frequent in certain areas

Distribution: From Plots: Duncan-Nanaimo: Neck Pt., Mt. Tzuhalem; Gulf Islands: Galiano Is.: Dionisio Pt.; Saturna Is.: Elliott Bluff; Pender Is.: Gowland Pt.; Portland Island; western shore: Rocky Pt. From Notes: Nanaimo to Duncan: Nanoose Hill, Newcastle Is., Woodley Range, Genoa Bay; Mayne Is.: Edith Pt.; Saanich Peninsula: Mt. Work, Observatory Hill, Thetis Lk. Pk; western shore: Mill Hill, Pedder Bay.

Plant Community Description: *Festuca idahoensis* (Idaho fescue) is present on all sites, and averages class 3 to 4 cover. *Sanicula crassicaulis* (Pacific snakeroot) occurs on all sites and averages class 2 to 3 cover. The remaining species occupy most sites. *Lonicera hispidula* (hairy honeysuckle) and *Elymus glaucus* (blue wildrye) average class 2 to 3 cover. *Bromus carinatus* (California brome grass), *Poa pratensis* (introduced Kentucky bluegrass), and *Galium aparine* (cleavers) average cover class 2. *Cerastium arvense* (field chickweed) averages class 1 to 2. *Hypochaeris radicata* (introduced hairy cats ear) averages cover class 1.

Tree Canopy/ Landscape Expression: mostly tree canopy (A) layer and high cover (5), some tall shrub (B1) layer canopy

Oak Characteristics: Diameters: chiefly small and medium;

Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Average stocking is moderately- to well-stocked for saplings and light to moderate for seedlings.

Physiognomic Type: usually Oak - Grass - Parkland (3) or Oak - Light Shrub - Herb - Bulb Parkland (2). Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.41 Adjusted Motyka Comparison: 1.52 Oak - *Festuca idahoensis* - *Cerastium arvense* subcommunity (c25); 1.04 Krummholz Oak- *Festuca idahoensis*- *Vicia americana* subcommunity (c42); 0.76 Oak- *Lonicera hispidula* (c16a); 0.58 Oak- *Mahonia aquifolium* (c26); 0.55 Oak- *Elymus glaucus* (c47); 0.29 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity (c27); 0.27 Oak- *Bromus*

carinatus (c43); 0.19 Oak- *Carex inops* (c14).

Elevation: mainly lower elevation (5) Slope: usually gentle to moderate

Aspect: all, but usually southeast (south) to west (5)

Surface Shape: straight (4) to convex (3) Moisture Regime: submesic to very xeric

Exposure: wind, insolation, some seaspray (3) Bedrock Geology: primarily sandstone (4) Surface Substrate Features: most plots (4) have moderate to high bedrock exposure (class 3 to 5) (4)

Soil Classification: generally Regosols (4) or Orthic Sombric Brunisols (3)

Humus Classification: usually Vermimulls (4) or Rhizomulls (2)

Depth of Ah Horizon: usually 5 to 20 cm (4), or > 30 cm (3)

Colour of Ah Horizon: dark, 10YR2/1 Depth to Bedrock: 7 to 20 cm(4) or none (3)

Surface Soil Texture: mostly coarse: loamy-sand to sandy loam, gravelly to very gravelly Percent Coarse Fragments: some high coarse fragments (60 to 90 %) in subsurface horizons (4)

Comments: This is an important community which has been overlooked in people's focus on the showy flower meadow communities.

Discussion:

Relatively coarse soils: loamy sand to sandy loam, and a primary occurrence at low elevations partly distinguish this plant community. It is probably one of the original three communities from which c21 and c2 are derived. The subcommunities, c27 and c25, may be derived from this subcommunity from recovery and disturbance, respectively.

Quercus garryana and *Festuca idahoensis* were used to name a plant community on an inland area, the Badger allotment of Mt. Hood National Forest, Oregon (Williams, 1978). These two species were associated with interior and southern species on a volcanic ridge north of the Grasshopper Valley in Lassen County, California (Vasek and Thorne, 1977). *Festuca idahoensis* was present in several of my U.S. plots, with a wide distribution. These were from the Oregon /California border (plot 92R OC01), from Whistler's Bend, Oregon (92R WB01 &

02), Fort Lewis Military Reserve (92R FL04) and Scatter Creek Reserve (92R SC01), Washington. Idaho fescue dominated in the first two of these plots. Another native fescue species, *Festuca californica*, was a dominant on my plot from the Bald Hills oak woodlands of Redwood National Park (92R BH01-b). *Festuca californica* is listed as a characteristic component of the Oregon White Oak map unit of California (Kuchler, 1977). Tunison (1973) described one community with *Festuca idahoensis* from Bennett Mt., Sonoma Co, California. Another of his communities was classified for *Festuca californica*. A *Festuca* species from one of the variants of the *Quercus-Erythronium* association was later typed as *Festuca idahoensis var. roemerii* (Roemer, 1972). This species was important in Roemer's *Quercus-Geranium (QG) Lomatium* subassociation. Salstrom (1989) included one plot with substantial *Festuca idahoensis* cover in the *Quercus garryana - Galium aparine* community on Pt. Disney, Waldron Island, Washington. *Festuca idahoensis* was a principal species used to name a non-oak grassland on Sucia Island, Washington (Fonda and Bernardi, 1976).

Festuca idahoensis has been suggested to have formerly dominated the Puget Sound and Willamette Valley prairies and oak woodlands (Schuller, 1993) and still has this role on the Ft. Lewis, Rocky and Mima Mounds prairies in western Washington (Clampitt, 1993; Chehalis Habitat Inventory Team, 1980), areas described by Daubenmire (1978) as a *Quercus garryana* savanna. *Festuca idahoensis* was used to name the *Festuca - Danthonia* grassland on the coastal prairie of northern California, a non-oak type (Heady et al., 1977). A *Festuca* species (possibly *F. idahoensis* ?) was present in the *Lomatium martindalei* provisional association, and a fescue identified as *Festuca rubra* in the *Viola adunca* provisional association from the Oregon "balds" (Aldrich, 1972). There is a discussion of *Bromus carinatus* in c43.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately high. Saplings are moderately-to well-stocked (above average). Seedlings are lightly- to moderately-stocked (above

average). Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of a high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees with medium or large tree attributes- bark glean, foliage glean, nesting, larger dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Sanicula crassicaulis is used as fresh sprouts in spring by deer and other grazing animals. Grass species such as *Festuca idahoensis* (Idaho fescue) are rated as moderately important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. There is also an attraction for thermal foraging and bedding on south slopes and bedrock exposure. Earthworms and other rich soil attributes are provided by this community. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

Lonicera hispidula is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*. There are a number of other skippers which feed on grasses not specifically known. These will probably include native species such as *Festuca idahoensis*, as suggested by studies of related species outside the British Columbia range. For example, this fescue is used by the Sonoran skipper (*Polites sonora*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low to moderate by oak diameter (size class)
- high to high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Glaucous tufts of *Festuca idahoensis* (Idaho fescue) add interest value. This community often occurs on sites with a view. *Lonicera hispidula* (hairy honeysuckle) has showy flowers which attract colourful hummingbirds and probably butterflies.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: moderately high

Restoration Potential: high

Restoration Priority: moderately high

Special Management: Grass dominated communities need special consideration for status assessments, as neither the communities, nor their species seem to get recognition as easily as those named for shrubs or forbs.

c25 Oak - Festuca idahoensis - Cerastium arvense subcommunity

Ecosystem Description:

Frequency of Occurrence: 6 plots, moderately frequent in certain areas

Distribution: From Plots: Duncan-Nanaimo: Piper's Lagoon, Mt. Tzuhalem; Gulf Islands: Gabriola Is., Tumbo Is., Saturna Is.: Elliott Bluff; western shore: Rocky Pt.

From Notes: Yellow Pt.: Deer Pt.; Pender Is.: Hermit Hill

Plant Community Description: *Festuca idahoensis* (Idaho fescue) and *Cerastium arvense* (field chickweed) thrive on all sites and average class 3 cover. *Achillea millefolium* (yarrow) grows on all sites and averages class 2 cover. The remaining species occur on most of the sites. *Bromus carinatus* (California brome grass), *Elymus glaucus* (blue wildrye), and *Anthoxanthum odoratum* (introduced sweet vernal grass)

average class 2 to 3 cover. *Galium aparine* (cleavers) and *Vicia sativa* (introduced common vetch) average class 2. *Rumex acetosella* (introduced sheep sorrel) averages class 1 cover.

Tree Canopy/ Landscape Expression: usually tall shrub (B1) layer canopy (4), some tree canopy (A) layer (2)

Oak Characteristics: Diameters: generally small (4); Regeneration: Saplings are present on most sites. Stocking averages light to moderate. Seedlings are present on some sites. Stocking averages light.

Physiognomic Type: usually Oak - Grass - Parkland (4).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.44 Adjusted Motyka Comparison: 1.52 Oak - *Festuca idahoensis*: Typic subcommunity

Elevation: primarily low elevation (4), some medium and high (2)

Slope primarily gentle to moderate slopes (6), one steep slope

Aspect: southeast to west Surface Shape: straight (3) or convex (3)

Moisture Regime: submesic to subxeric (one very xeric)

Exposure: insolation, wind, some seaspray (3)

Bedrock Geology: mainly coarse, sandstone, granitic (4)

Surface Substrate Features: some plots (3) have either moderate to high (class 3 to 5) bedrock exposure (2) or moderately high surface rocks (class 3) (2)

Soil Classification: Orthic Humic Regosols (3) or Orthic Sombric Brunisols (2)

Humus Classification: Orthi Rhizomulls (3) or Vermimulls (3)

Depth of Ah Horizon: chiefly > 15 to 30 cm, some shallow (10 to 12 cm) (2)

Colour of Ah Horizon: mostly dark, 10YR2/1, 2/1.5 (5)

Depth to Bedrock: none (3), or 10 to 25 cm (3)

Surface Soil Texture: sandy loam to silt loam, generally gravelly (5)

Percent Coarse Fragments: various (15 to 85 %)

Discussion:

This subcommunity is partly distinguished by its primary occurrence at lower

elevations. The subcommunity, c27, may be a stage in recovery toward this subcommunity. This subcommunity could be derived through disturbance from c20 and is probably one of the original three communities from which c21 and c2 originate.

There are no types classified for these species in the literature on oak woodlands. *Cerastium arvense* was among the five species recognized by Roemer (1972) in the *Quercus-Bromus (carinatus) Alliance*. *Achillea millefolium* is also shared in common. *Cerastium arvense* was present in the *Viola adunca* provisional association from the Oregon "balds", a non-oak area (Aldrich, 1972). *Cerastium arvense* is prominent in the *Stipa richardsonii* grassland association of the Cariboo in the interior of British Columbia. There is a discussion of *Festuca idahoensis* in c20 and *Vicia sativa* in c29a.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately low. Seedlings are only present on some sites. Saplings are only lightly- to moderately-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees with medium or large tree attributes- bark glean, foliage glean, nesting, larger dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Grass species such as *Festuca idahoensis* (Idaho fescue) are rated as moderately

important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. There is also an attraction for thermal foraging and bedding on south slopes and bedrock exposure. Earthworms and other rich soil attributes are provided by this community. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

Composites such as *Achillea millefolium* (yarrow) provide nectar for butterflies such as silvery blue (*Glaucopsyche lygdamus*), mylitta cresecent spot (*Vanessa cardui*, *V. annabella*). *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*. There are a number of other skippers which feed on grasses not specifically known. These will probably include native species such as *Festuca idahoensis*, as suggested by studies of related species outside the British Columbia range. For example, this fescue is used by the Sonoran skipper (*Polites sonora*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

This community often occurs on sites with a view. Glaucous tufts of *Festuca idahoensis* (Idaho fescue) add interest value. The foliage and flowering of *Cerastium arvense* (field chickweed) and *Achillea millefolium* (yarrow) add interest value and appeal to this community, enhanced by the latter species staying green into the summer. *Achillea millefolium* (yarrow) has cultural heritage value for its historic aboriginal medicinal use.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: moderately high

Restoration Potential: high

Restoration Priority: moderately high

Special Management: Tree protection devices or other measures may be required against deer browsing if adequate regeneration is to be achieved.

c27 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity

Ecosystem Description:

Frequency of Occurrence: 4 plots, infrequent

Distribution: From Plots: Gulf Islands: Mayne Is: s. Heck Hill; Saturna Is.: Mt. Warburton Pike and East Pt.; Saltspring Is.: Mt. Maxwell From Notes: none

Plant Community Description: *Festuca idahoensis* (Idaho fescue) is present on most sites and averages class 3 cover. *Trifolium microcephalum* (woolly clover) occurs on all sites and averages class 3 cover. *Elymus glaucus* (blue wildrye), *Cerastium arvense* (field chickweed), and *Selaginella wallacei* (Wallace's selaginella) occupy all sites and average cover class 1, 2, and 2, respectively.

The remaining species grow on most of the sites. *Carex inops* (long-stoloned sedge) and *Bromus sterilis* (introduced barren barngrass) average cover class 3. *Galium aparine* (cleavers), *Hypochaeris radicata* (introduced hairy cats ear), and *Rhacomitrium canescens* (gray frayed-cap moss) averages cover class 2. *Aira caryophyllea* (silver hairgrass) averages cover class 1 to 2. *Bromus carinatus* (California bromegrass), *Rumex acetosella* (introduced sheep sorrel), and *Trifolium oliganthum* (few-flowered clover) average cover class 1.

Tree Canopy/ Landscape Expression: largely high cover (class 5) (3), tree canopy (A) layer

Oak Characteristics: Diameters: various; Regeneration: There is regeneration for both saplings and seedlings on some sites. Stocking averages light for both.

Physiognomic Type: various Suggested Successional Status: Mature Edaphic Climax:

thought to be a recovery stage within this general state

Constant Cover Value: 0.62 Adjusted Motyka Comparison: 0.29 Oak - *Festuca idahoensis*: Typic subcommunity.

Elevation: usually high elevation (3), one medium elevation

Slope: moderate to very steep Aspect: south to west

Surface Shape: various Moisture Regime: chiefly subxeric

Exposure: insolation, wind Bedrock Geology: coarse: sandstone, gneiss

Surface Substrate Features: all plots have either moderate to high bedrock exposure (class 3 to 4) (4) or moderately high surface rocks (class 3) (3)

Soil Classification: Orthic Sombric Brunisols (3)

Humus Classification: Rhizomulls (3) Depth of Ah Horizon: 20 to > 30 cm

Colour of Ah Horizon: dark, 10YR2/1 and dark and slightly brownish

Depth to Bedrock: mainly without Surface Soil Texture: loamy-sand to loam

Percent Coarse Fragments: various, some high (1)

Comments: *Koeleria macrantha* and/or *Danthonia californica* may have replaced *Festuca idahoensis* in certain areas. Other areas with high *Trifolium microcephalum*, but no *Festuca idahoensis* are thought to be derived from this community (e.g. 93SH01, 93SS10, 14, & 15). This type (c27) is related to the Oak - *Rhacomitrium canescens* - *Selaginella wallacei* type (c46).

Discussion:

Relatively coarse soils: loamy sand to loam and a primary occurrence at higher elevations partly distinguish this subcommunity. It may be a recovery stage of c20 or c25 and is probably one of the original three communities from which c21 and c2 are derived.

There are no types classified for these species in the literature on oak woodlands. *Trifolium microcephalum* was an important species in the *Quercus-Geranium (QG) Lomatium* subassociation of Roemer (1972). *Trifolium oliganthum* was important in Roemer's unit and c27. *Trifolium microcephalum* was part of a

community described by Janszen (1977; 1981) for Saturna and Mayne Islands. There is a discussion of *Festuca idahoensis* in c20, *Aira caryophyllea* in c50, *Selaginella wallacei* in c46 and *Bromus sterilis* in c23.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is very low. Saplings and seedlings are only present on some sites. Saplings are only lightly-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some stands or trees with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Grass species such as *Festuca idahoensis* (Idaho fescue) are rated as moderately important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. There is also an attraction for thermal foraging and bedding on south slopes and bedrock exposure. The rockiness and exposure of this community's environment provides habitat for garter snakes and northern alligator lizard (*Gerrhonotus coeruleus*) and potential for snake hibernacula. The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*) as they would formerly have been for western bluebirds (*Sialia mexicana*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees

(*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

Trifolium microcephalum (woolly clover) is probably a larval food plant for northern cloudywing (*Thorybes plyades*) and the endangered greenish blue butterfly (*Plebejus saepiolus insulanus*), both of which use *Trifolium*. There are a number of skippers which feed on grasses not specifically known. These will probably include native species such as *Festuca idahoensis*, as suggested by studies of related species outside the British Columbia range. For example, this fescue is used by the Sonoran skipper (*Polites sonora*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Glaucous tufts of *Festuca idahoensis* (Idaho fescue) and the flowering of *Trifolium microcephalum* (woolly clover) add interest value to this community. The foliage and flowering of *Cerastium arvense* (field chickweed), present in small to moderate amounts, adds interest value and appeal. *Selaginella wallacei* (Wallace's selaginella)

and *Carex inops* (long-stoloned sedge), present in moderate amounts, enhance later-season aesthetics by remaining green into the summer. This plant community is often on sites with a view near the top of hills which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: moderately high

Restoration Potential: very high

Restoration Priority: high

Special Management:

Special measures will have to be take to help achieve successful oak regeneration and realize the restoration potential of this community. Tree protection devices or other measures may be required against deer browsing. *Trifolium microcephalum* (woolly clover) is important to this community for its potential role in recovery and ability to fix atmospheric nitrogen. This ability is shared by *Trifolium oliganthum* (few-flowered clover). Together these clovers should be given consideration for their yellow (potentially vulnerable) status.

c42 Krummholz Oak - *Festuca idahoensis* - *Vicia americana* subcommunity

Ecosystem Description:

Frequency of Occurrence: 6 plots, moderately frequent in certain areas

Distribution: From Plots: Yellow Point: Flewitt Pt.; Gulf Islands: Gabriola Is. islet, Mayne Is.: Edith Pt.; Saltspring Is.: Ruckle Pt.; western shore: Rocky Point

From Notes: none: plot 93 NB01 from Nanoose Bay could be added

Plant Community Description: *Festuca idahoensis* (Idaho fescue) occurs on most sites and averages class 2 to 3 in cover. *Vicia americana* (American vetch) occupies all sites and averages class 3 cover. *Galium aparine* (cleavers) and *Vicia sativa* (introduced common vetch) grow on all sites and average class 2 cover. *Cerastium*

arvense (field chickweed) is present on all sites and averages class 1 cover. The remaining species exist on most sites. *Symphoricarpos albus* (snowberry) averages class 2 to 3 cover. *Bromus carinatus* (California brome grass), *Poa pratensis* (introduced Kentucky bluegrass), and *Sanicula crassicaulis* (Pacific snakeroot) average class 2 cover. *Camassia leichtlinii* (great camas) averages class 1 to 2.

Tree Canopy/ Landscape Expression: krummholz, wind-trained low (B2) to tall (B1) shrub layer canopy, sometimes grading up to a low tree layer (A3) canopy with distance away from the sea (3).

Oak Characteristics: Diameters: primarily small; Regeneration: Regeneration was observed on all sites for saplings and on most sites for seedlings. Saplings average (very) well-stocked. Seedlings average moderately well- to well-stocked.

Physiognomic Type: usually Shrub Oak - Krummholz - Sea-edge (4), sometimes combined with Oak - Moderate Shrub - Herb - Parkland (2).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.39 Adjusted Motyka Comparison: 1.04 Oak - *Festuca idahoensis*: Typic subcommunity (c20); 0.49 Oak- *Bromus carinatus* (c43).

Elevation: sea-edge: 2 to 20 m Slope: gentle to moderate Aspect: various and west (3) Surface Shape: usually convex (4), or hummocky/irregular (2)

Moisture Regime: subxeric to xeric Exposure: seaspray zone, wind, insolation

Bedrock Geology: coarse: sandstone, granitic (4)

Surface Substrate Features: most plots (5) have either moderate to high bedrock exposure (class 3 to 4) (3) or moderately high surface rocks (class 3) (3)

Soil Classification: usually Regosols (4), some Orthic Sombric Brunisols (2)

Humus Classification: Orthi Rhizomulls (3) or Vermimulls (3)

Depth of Ah Horizon: 5 to 30 cm, or > 25 to 30 cm

Colour of Ah Horizon: generally dark, 10YR2/1, 2/1.5 (5)

Depth to Bedrock: none, or 5 to 20 cm (3) Surface Soil Texture: usually silt loam (4), usually gravelly (5) Percent Coarse Fragments: usually moderate or high

Comments: The classification requirement was lowered for *Vicia americana* in this

community: being set at $> =$ cover class 2. The oaks of this community grow to a height of perhaps 20 cm where most exposed to the wind on the sea-edge. They then grade upwards in a continuous mat with distance away from the exposure. The term *krummholz* is used to describe this stunted form (see 5.13).

An Oak - *Vicia americana* parkland type was recognized from Galiano Island, but was dropped, being represented by only two plots. The type is thought to reflect reduced deer grazing pressure on the island. Reconnaissance notes also suggest this parkland type is present at Yellow Pt.: Boathouse Harbour north, Deer Pt., Flewitt Pt.; Water Tower Hill and Summit Pk.

There were other occurrences of the *krummholz* sea-edge form of oak without *Vicia americana*. One plant community with a couple of these occurrences is c43 Oak - *Bromus carinatus*.

Discussion:

The sea-edge occurrence in wind exposed sites distinguishes this subcommunity. When disturbed it may convert into the sea-edge occurrence of the community, c43.

There are no types classified for these species in the literature on oak woodlands. *Vicia americana* was part of the dominant species-combination in the *Quercus-Erythronium-Montia-Fragaria* variant of Roemer (1972). *Vicia americana* was used to name a non-oak forested community on Sucia Island, Washington (Fonda and Bernardi, 1976). There is a discussion of *Festuca idahoensis* in c20.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is very high. Saplings present on all sites and (very) well-stocked. Seedling stocking above average: light to moderately well. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of

physiognomic type (Shrub Oak- Krummholz- Sea Edge) to which this plant community has been assigned:

- oaks for browse and perches, and with shrubs, dense hiding and security cover
- thermal bedding, windy: for escape from biting insects
- diverse wildlife with the edge position
- oak and deciduous litter, rich soil resources, such as earthworms
- adjacent to the resources of openings; seeds, foraging space, grasshoppers, fresh sprouts, nectar

Grass species such as *Festuca idahoensis* (Idaho fescue) are rated as moderately important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer (Blower, 1982), but appears to be higher as I recorded several spring utilization records. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by deer and other grazing animals. The community is also habitat for snakes; the seaside occurrence of this community making it ideal habitat for the western garter snake (*Thamnophis elegans*). The rockiness of the substrate of this community gives it the potential to provide hibernacula.

Symphoricarpos albus (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Vicia americana* (American vetch) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), western tailed blue (*Everes amyntula*), and the endangered greenish blue butterfly (*Plebejus saepiolus insulanus*), all of which use *Vicia*. So also would western sulphur (*Colias occidentalis occidentalis*), were this butterfly not extirpated from the Garry oak areas. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*. There are a number of other skippers which feed on grasses not specifically known. These will probably include native species such as *Festuca idahoensis*, as suggested by studies of

related species outside the British Columbia range. For example, this fescue is used by the Sonoran skipper (*Polites sonora*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low by oak diameter (size class)
- high by form-class within physiognomic type
- low by oak form-complexity within physiognomic type

There is interest value in the low gnarled and sweeping form of oak in this community. Glaucous tufts of *Festuca idahoensis* (Idaho fescue) and the flowering of *Vicia americana* (American vetch) give interest and aesthetic value to this community. *Symphoricarpos albus* (snowberry), present in moderate to substantial amounts, adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. The flowering of *Camassia leichtlinii* (great camas), present in small to moderate amounts, complements the other features. This community occurs in locations with seascape views.

Susceptibility to Disturbance: very high

Prescribed Fire: should not be considered in this plant community.

Threats: high

Restoration Potential: high

Restoration Priority: high

Special Management:

Any burning plans would conflict with populations of western tailed blue (*Everes amyntula*), which winter in *Lathyrus* and *Vicia* seedpods and with the sensitivity of these sites.

c47 Oak - *Elymus glaucus*

Ecosystem Description:

Frequency of Occurrence: 14 plots, frequent

Distribution: From Plots: widespread: Duncan to Nanaimo: Nanoose Hill, Mt. Tzuhalem; southern Gulf Islands: Galiano Is.: Mt. Galiano, Bluffs Pk., Arbutus Pt.; Pender Is.: George Hill; Saltspring Is.; Saanich Peninsula: Mt. Work, Lone Tree Hill, Bear Hill, Observatory Hill, Knockan Hill From Notes: Nanaimo: Neck Pt., Jack Pt., Harewood Plains; Galiano Is.: Mayne Island: Navy Channel; Pender Is.: Stanford Hill; Saanich Peninsula: Water Tower Hill, Lohbrunner Rd., Thetis Lk. Pk.; western shore: Rocky Pt.

Plant Community Description: *Elymus glaucus* (blue wildrye) is present on all sites and averages cover class 3 to 4. The remaining species occur on most sites. *Carex inops* (long-stolonated sedge) averages cover class 2 to 3. *Galium aparine* (cleavers) and *Sanicula crassicaulis* (Pacific snakeroot) average cover class 2.

Tree Canopy/ Landscape Expression: chiefly tree (A) layer canopy (10), and some tall shrub (B1) layer canopy (4)

Oak Characteristics: Diameters: various; Regeneration: There is regeneration on most sites. Stocking averages moderate for saplings and light to moderate for seedlings.

Physiognomic Type: various: some Oak - Grass - Parkland (3).

Suggested Successional Status: Mature Edaphic Climax and Mature Climatic Climax
Constant Cover Value: 0.27 Adjusted Motyka Comparison: 0.60 Oak - Broom - *Elymus glaucus* (c6); 0.57 Oak - *Carex inops* (c14); 0.57 Oak - *Lonicera hispidula* (c16a); 0.55 Oak - *Festuca idahoensis*: Typic subcommunity (c20); 0.49 Oak - *Mahonia aquifolium* (c26); 0.36 Oak - *Bromus sterilis* (c23); 0.09 Oak - *Cynosurus echinatus* (c21).

Elevation: mainly medium to high elevation Slope: gentle to very steep

Aspect: primarily southeast (south) to west, (some northeast, northwest)

Surface Shape: straight (8), concave (4) Moisture Regime: quite a few compensating submesic and mesic (6), otherwise subxeric to submesic with some seepage

Exposure: insolation, wind (7) Bedrock Geology: various

Surface Substrate Features: most plots (8) have either moderate to high surface rocks

(class 3 or 4) (4) or moderate to high bedrock exposure (6)

Soil Classification: usually Orthic Sombric Brunisols (11), some Regosols (3)

Humus Classification: Rhizomulls (7) and Vermimulls (7)

Depth of Ah Horizon: 8 to 30 cm (8), and > 25 to 35 cm (6)

Colour of Ah Horizon: dark, 10YR2/1, 2/1.5 (9), or dark and slightly brownish

Depth to Bedrock: chiefly without (7), or 8 to 70 cm (estimated) (7)

Surface Soil Texture: sandy loam to silt loam, gravelly to very gravelly

Percent Coarse Fragments: often high subsurface coarse fragments (8)

Comments: *Symphoricarpos albus* might have provided a division for c47, but this shrub type was not frequent enough, being represented by only 4 plots.

Discussion:

This community usually occurs on medium to high elevation sites, which partly distinguishes it. It may be the original community for c43 and c41 before disturbance and recovery, although it tends to be on more extreme sites than the latter. Disturbance may also have lead to the derivation of c23, c28b, c28a, c30, c49, c5, c29a, c4, c31a and b.

Elymus glaucus was featured in the naming of an oak community from southwestern Oregon (Riegel et al., 1992), but not from elsewhere. There was an *Elymus* group, which included *Quercus garryana*, in the *Arbutus-Pseudotsuga* association of Roemer (1972), in which *Quercus garryana* is of lesser importance. Oak types with prominent *Elymus glaucus* have been recorded for the Saanich Peninsula by Roemer (1972), the Mill Creek Research Natural Area south of Hood River, Oregon by Franklin (1972), Corvallis, Oregon by Hall (1956) and Hedrick et al. (1959), the Willamette Valley by Thilenius (1964), the Bald Hills of northern California by Sugihara et al., (1987), and the Soldier Research Natural Area, California by Keeler-Wolf (1990). *Elymus glaucus* (blue wildrye) was present in my plots from the Bald Hills, Champoeg State Park, Oregon, the Fort Lewis Military Reserve, and Klickitat River, Washington. Salstrom (1989) included a few plots with

moderate or substantial *Elymus glaucus* cover in the *Pseudotsuga menziesii* - *Quercus garryana* - *Lonicera hispidula* community on Pt. Disney, Waldron Island, Washington.

George et al.(1992) have suggested that *Elymus glaucus* may have been one of the major dominants of the California grasslands before the changes associated with European colonization and is ascribed this role by Heady et al.(1977) for portions of the coastal prairie. *Elymus glaucus* was used to name a provisional association of Aldrich (1972) from the "balds" of the Oregon Coast Range: a non-forested, non-oak type. Blue wildrye is one of the characteristic species of the Puget Sound prairies by Sharpe (in prep.) and is a typical species of the grasslands of the Willamette Valley (Franklin and Dyrness, 1973).

Elymus glaucus was among the species featured in the *Rhus-Gramineae* variant of Thilenius (1964) and occurred in the *Quercus-Geranium* association of Roemer (1972). *Elymus glaucus* is among three species from Roemer's (1972) study which were typical of the entire range of Garry oak stands from other studies. *Sanicula crassicaulis* was the another species held in common with c47. There is a discussion for *Galium aparine* under c43. *Elymus glaucus* was the third most frequent species (1993) and the sixth (1993) or seventh (1994) highest in total cover from my sampling. For these reasons, *Elymus glaucus* is the best candidate to join *Symphoricarpos albus* in naming a *Quercus garryana* Alliance. Nonetheless, if *Symphoricarpos albus* is used in the name a qualification should be made explaining that there was actually a tension between this shrub and herbs, such as *Elymus glaucus*, with less of the shrub cover than at present under a natural fire and deer browsing regime.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately high. Seedlings lightly- to moderately-stocked (above average). Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of

physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some stands or trees with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Grass species such as *Elymus glaucus* (blue wildrye) are rated as moderately important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. There is also an attraction for thermal foraging and bedding on south slopes and bedrock exposure. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by Coast deer and other grazing animals. The rockiness and exposure of this community's environment provides habitat for garter snakes and northern alligator lizard (*Gerrhonotus coeruleus*) and potential for snake hibernacula. The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*) as they would formerly have been for western bluebirds (*Sialia mexicana*). Earthworms and other rich soil resources are provided by this community and taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas

formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

There are a number of skipper butterfly larvae which feed on grasses not specifically known. These will probably include native species such as *Elymus glaucus*, as suggested by studies of related species outside the British Columbia range.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Carex inops (long-stoloned sedge), present in moderate to substantial amounts, enhances later-season aesthetics by remaining green into the summer. *Galium aparine* (cleavers) has cultural heritage value for its historic aboriginal technological use. This plant community is often near the top of hills which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: moderately high

Restoration Potential: very high

Restoration Priority: very high

Special Management:

Elymus glaucus (blue wildrye) has been selected as a cultivar and has strong potential for restoration. Selections should be taken from this plant community.

c41 Oak - *Lathyrus nevadensis*

Ecosystem Description:

Frequency of Occurrence: 5 plots

Distribution: **From Plots:** Galiano Island: Arbutus Pt., Saanich Peninsula: Summitt Pk., Beacon Hill Park; western shore: Juan de Fuca Pk. **From Notes:** Nanaimo: Jack Pt.; Yellow Pt.: Flewitt Pt.; Gore Pk., Knockan Hill, Thetis Lk. Pk.

Plant Community Description: *Lathyrus nevadensis* (peavine) is present on all sites and averages class 3 to 4 in cover. *Sanicula crassicaulis* (Pacific snakeroot) and *Dactylis glomerata* (introduced orchardgrass) occupy all sites and average class 2 and 3, respectively. The remaining species occur on most sites. *Symphoricarpos albus* (snowberry) and *Camassia leichtlinii* (great camas) average cover class 3. *Festuca bromoides* (introduced annual fescue), *Bromus sterilis* (introduced barren barngrass), *Poa pratensis* (introduced Kentucky bluegrass), *Vicia sativa* (introduced common vetch) and *Plantago lanceolata* (introduced narrow leaved plantain) average cover class 2.

Tree Canopy/ Landscape Expression: all tree (A) layer canopy, mainly high cover (class 5,6) (5)

Oak Characteristics: **Diameters:** primarily medium to large;

Regeneration: Regeneration is present on some sites for saplings and most sites for seedlings. Stocking averages moderate for saplings and light for seedlings.

Physiognomic Type: usually Oak - Light Shrub - Herb - Bulb Parkland.

Suggested Successional Status: Mature Climatic Climax

Constant Cover Value: 0.51 **Adjusted Motyka Comparison:** 0.59 Oak - *Dactylis glomerata*: Typic subcommunity (c28a);

Elevation: low to medium elevation **Slope:** gentle slopes, 5 to 20 %

Aspect: east (south) to west **Surface Shape:** straight

Moisture Regime: mesic to submesic (5) **Exposure:** some wind (2)

Bedrock Geology: generally without, sandstone (1)

Surface Substrate Features: all plots have either moderate to high (class 3 or 4)

surface bedrock exposure (3) or moderately high (class 3) surface rocks

Soil Classification: Orthic Sombric Brunisols

Humus Classification: Vermimulls (3) and Rhizomulls (2)

Depth of Ah Horizon: 20 cm (2), or > 10 to 30 cm

Colour of Ah Horizon: usually dark, 10YR 2/1, 2/1.5 (4)

Depth to Bedrock: none Surface Soil Texture: chiefly loam (4), some gravelly (3)

Percent Coarse Fragments: low or medium (15 to 40 %)

Comments: most plots were of the parkland physiognomic type. However, one plot from Galiano Island (94 GALI02) was a krummholz, sea-edge stand.

Discussion:

Submesic to mesic ecological moisture regime, low subsurface coarse fragments, occurrence primarily at low elevations, partly on concave sites; all contribute to distinguishing this community. It may be derived from c47 or c43 through disturbance and recovery, although it occurs on less extreme sites. A group of communities which may be derived from c41 consists of c28b, c28a, c30, c49, and c5.

There are no types classified for these species in the literature on oak woodlands. *Lathyrus nevadensis* was among a group of dominant species in the *Quercus-Erythronium* (QE) of Roemer, 1972. Salstrom (1989) included a few plots with moderate or substantial *Lathyrus nevadensis* cover in the *Pseudotsuga menziesii* - *Quercus garryana* - *Lonicera hispidula* community on Pt. Disney, Waldron Island, Washington. Although not described for oak woodlands, peavine communities are well developed as an understory to aspen in the interior of British Columbia (pers.obs).

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately low. Sapling regeneration only present on some sites. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Light Shrub Cover- Herb - Bulb Parkland) to which this plant community has been assigned:

- thermal bedding and foraging on moderate to moderately steep south to west slopes, bedrock and rock exposure
- fresh sprouts, foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- large tree attributes: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Camas is heavily preferred as fresh sprouts in spring by deer and other grazing animals. *Sanicula crassicaulis* is also used. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. The large diameter oaks of this plant community provide tree hollows which are a focal habitat feature for raccoons (*Procyon lotor*). Earthworms and other rich soil attributes are provided by this community and taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions.

Symphoricarpos albus (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies, and is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Lathyrus nevadensis* (peavine) is a larval food for spring azure (*Celastrina ladon*) butterflies, and probably also for silvery blue (*Glaucopsyche lygadamus*) and western tailed blue (*Everes amyntula*), which use *Lathyrus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as very high, especially because of the spring flower show provided by this community. The rating is also based on the following:

- mostly very high by physiognomic type
- moderate to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Lathyrus nevadensis (peavine) adds to the aesthetic value of this community with its late-season flowering. *Symphoricarpos albus* (snowberry) enhances aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Camassia leichtlinii* (great camas) has cultural heritage significance for its use as an edible bulb by aboriginal people.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: very high

Restoration Potential: very high

Restoration Priority: very high

Special Management:

Lathyrus nevadensis (peavine) is particularly important to this community for its ability to fix atmospheric nitrogen and its restoration potential. Peavine is cultivated and used in native plant gardening. Any burning plans should consider the conflict with populations of western tailed blue (*Everes amyntula*), which winter in *Lathyrus* and *Vicia* seedpods.

c43 Oak - *Bromus carinatus*

Ecosystem Description:

Frequency of Occurrence: 6 plots, moderately frequent

Distribution: From Plots: southern Gulf Islands: rocky islet off Cabbage Is., Galiano Is.; Bellhouse and Dionisio Pts.; Saanich Peninsula: Mt. Doug.; western shore: Rocky Pt. From Notes: Yellow Pt.: s. of Joan Pt., Deer Pt.; Newcastle Is., Gabriola Is., Tumbo Is., Glencoe Cove.

Plant Community Description: *Bromus carinatus* (California brome grass) occupies all sites and averages cover class 3 or 4. *Vicia sativa* (introduced common vetch), *Galium aparine* (cleavers), and *Camassia leichtlinii* (great camas) occur on all sites and average class 2, 2 to 3, and 2, respectively. The other species listed were present on most sites. *Bromus sterilis* (introduced barren barngrass) and *Galium aparine* (cleavers) averages cover class 2 to 3. *Elymus glaucus* (blue wild-rye) average cover class 1.

Tree Canopy/ Landscape Expression: mainly tall shrub (B1) layer canopy (4), some tree layer (A) layer canopy

Oak Characteristics: Diameters: small to medium; Regeneration: Saplings were well-stocked on all sites. Seedlings are regenerating on most sites and average moderately- to well- stocked.

Physiognomic Type: usually Oak - Grass Parkland (2) or Shrub Oak - Krummholz - Sea-edge (2). Suggested Successional Status: primarily Mature Edaphic Climax

Constant Cover Value: 0.39. Adjusted Motyka Comparison: 0.48 Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity (c28b); 0.39 Oak - *Dactylis glomerata*: Typic subcommunity (c28a); 0.27 Oak - *Festuca idahoensis*: Typic subcommunity (c20); 0.20 Oak - *Elymus glaucus* (c47).

Elevation: low elevation, high elevation Slope: gentle to steep

Aspect: primarily south to southwest (4) Surface Shape: generally straight (4)

Moisture Regime: usually subxeric to submesic (5), mesic (1)

Exposure: insolation, wind, some seaspray (2)

Bedrock Geology: coarse: granitic, conglomerate, sandstone

Surface Substrate Features: some moderate to high (class 3 to 5) surface rockiness (2), or moderately high surface bedrock exposure (class 3) (1)

Soil Classification: Orthic Sombric Brunisols (5) Humus Classification: Vermimulls

Depth of Ah Horizon: deep, mostly 25 to 30 cm

Colour of Ah Horizon: chiefly dark, 10YR2/1 (4), some dark and slightly brownish

Depth to Bedrock: largely without bedrock, one is 15 cm

Surface Soil Texture: mainly sandy loam to loam (5), usually gravelly to very gravelly (5)

Percent Coarse Fragments: usually high surface or subsurface coarse fragments (4)

Comments: Four of these plots are very near the sea, and the other two are post-burn on Mt. Doug. This plant community is probably not as visually obvious as the others. It was not directly recognized as a community in the field work, although its potential to form a group was recognized. This potential was then confirmed by a check of the data.

Discussion:

High surface or subsurface coarse fragments may be a factor distinguishing this community. The sea-edge occurrence in wind exposed sites partly distinguishes this community. Disturbance of c42 may account for its sea-edge occurrence. Other occurrences may originate from c47 after disturbance and recovery. It may be one of the original communities for c41, although it is usually on more extreme sites. It may be one of the original communities for c23, c28b, c28a, c30, c49, c5, c31a and b, c29a, and c4.

A *Quercus garryana*/*Bromus carinatus* community was outlined by Riegel et al., (1992) for southwestern Oregon. Related types have been described for the the Bald Hills oak woodlands of northern California by Sugihara et al., (1987). Roemer (1972) classified the oak community on the Saanich Peninsula into the *Quercus-Bromus Alliance*, in recognition of *Bromus carinatus* and five other species. Of these, *Vicia sativa* is constant in c43. A California Brome understory type has been recognized in

association with bedrock outcrops for the CDF biogeoclimatic zone (Nyberg and Janz, 1990). An Alaska bromegrass-*Rhacomitrium* moss-rock outcrop unit with stunted Garry oak occurred away from the ocean on Galiano, Thetis, Kuper, and Valdes Islands (Pattison and Karanka, 1981). The type was named for *Bromus sitchensis*, not *B. carinatus*, but there have been taxonomic difficulties with these species.

Bromus carinatus occurs in both the non-oak *Elymus glaucus* provisional association of Aldrich (1972) from the Oregon "balds" and the *Quercus-Geranium* association of Roemer (1972). *Bromus carinatus* dominated some non-oak coastal prairie sites in California (Heady et al., 1977). *Galium aparine*, constant with substantial cover in c43, was recognized in a *Quercus garryana* / *Galium aparine* woodland on Pt. Disney, Waldron Island, Washington by Salstrom (1989). *Galium aparine* is among three species from Roemer's (1972) study which were typical of the entire range of Garry oak stands from other studies.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is very high. Sapling regeneration present on all sites and well-stocked. Seedlings moderately well-stocked (above average). Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees or stands with medium or large tree attributes: bark glean,

foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

There is also an attraction for thermal foraging and bedding on south slopes and bedrock exposure. The rockiness and exposure of this community's environment provides habitat for garter snakes and northern alligator lizard and potential for snake hibernacula. The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*) as they would formerly have been for western bluebirds (*Sialia mexicana*). Earthworms and other rich soil resources are provided by this community and taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

Some stands have the following additional physiognomic type characteristics (Shrub oak- Krummholz- Sea edge):

- oaks for browse and perches, and with shrubs, dense hiding and security cover

- thermal bedding, windy: for escape from biting insects
- diverse wildlife with the edge position
- oak and deciduous litter
- adjacent to the resources of openings; including nectar

Grass species such as *Bromus carinatus* (California brome) are rated as moderately important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. Seaside occurrences make ideal habitat for the western garter snake (*Thamnophis elegans*). *Bromus carinatus* (California brome) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low to moderate by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Camassia leichtlinii (great camas), present in moderate amounts, gives early-season appeal with its flowering and interest value with its seed heads. Camas has cultural heritage value for its historic aboriginal food use, *Galium aparine* (cleavers) for its use in technology. *Vicia sativa* (introduced common vetch), present in moderate amounts, provides some later-season appeal with its flowering and interest value with its pods. This community usually occurs on sites with views, partly of the seascape.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is high for upland occurrences. Prescribed fire should not be considered for the krummholz form, sea-edge occurrences.

Threats: moderately high

Restoration Potential: very high

Restoration Priority: high

Special Management:

Bromus carinatus (California brome grass) has been cultivated and has a high potential for restoration. Selections should be taken from this plant community.

c14 Oak - *Carex inops*Ecosystem Description:

Frequency of Occurrence: 6 plots, moderately frequent

Distribution: From Plots: Hornby Island, Nanoose Bay, Nanoose Hill, Nanaimo: Westwood Dr., Saltspring Is.: Mt. Tuam. From Notes: Ladysmith: Woodley Range; Duncan: Genoa Bay; Saanich Peninsula: Thetis Lk. Pk.

Plant Community Description: *Carex inops* (long-stoloned sedge) thrives on all sites and averages a cover of class 4. *Vicia sativa* (introduced common vetch) is present on all sites and averages class 1 to 2 cover. The remaining species occur on most sites. *Elymus glaucus* (blue wildrye) *Ranunculus occidentalis* (western buttercup), *Galium aparine* (cleavers), and *Vicia hirsuta* (introduced hairy vetch) average class 2 cover. *Danthonia californica* (California oatgrass) and *Rumex acetosella* (introduced sheep sorrel) average class 1 cover.

Tree Canopy/ Landscape Expression: generally tree layer (A) canopy layer, often high cover (class 5 or 6) (3)

Oak Characteristics: Diameters: various; Regeneration: Regeneration is present on some sites for saplings and most sites for seedlings. Stocking averages moderate for saplings and light for seedlings.

Physiognomic Type: various: some Oak - Grass - Parkland (2).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.34 Adjusted Motyka Comparison: 0.57 Oak- *Elymus glaucus* (c47); 0.29 Oak- *Poa pratensis* (c29a); 0.21 Oak- *Anthoxanthum odoratum* (c31a); 0.19 Oak - *Festuca idahoensis*: Typic subcommunity (c20).

Elevation: low to high (3) elevation Slope: usually gentle to moderately steep

Aspect: east to south Surface Shape: straight (3), concave (2), or hummocky (1)

Moisture Regime: usually subxeric to submesic (ranges from xeric to permesic)
Exposure: wind (4), insolation (3) Bedrock Geology: various
Surface Substrate Features: some (2) have moderately high bedrock exposure (class 3)
Soil Classification: Orthic Sombric Brunisols (3) or Orthic Humic Regosols (3)
Humus Classification: Rhizomulls (4) or Vermimulls (2)
Depth of Ah Horizon: usually 10 to 25 cm Colour of Ah Horizon: dark, 10YR2/1 (5)
Depth to Bedrock: none, or 20 to 30 cm
Surface Soil Texture: silt loam, usually very gravelly (4)
Percent Coarse Fragments: usually high (55 to 70 %) (4)
Comments: This community may be geographically confined within its generally widespread distribution. In my sampling it was represented only from the '93 plots.

Discussion:

Occurrence on silt loam textured soils may be one factor which distinguishes this plant community. It is thought to occur on different types of sites than the several above. Its composition may also reflect the influence of more complete oak stands. The communities, c29a and c4, are thought to be partly derived from this community.

There are no types classified for these species in the literature on oak woodlands. *Carex inops* was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). One oak savannah plot on Cady Mt., Waldron Island, Washington was dominated by *Carex inops (pennsylvanica)* (Washington Conservation Data Centre, 1993). There is a discussion of *Ranunculus occidentalis* in c37b.

Interpretations:

Preservation Priority: Very high by general ranking.

Regeneration: Regeneration potential is moderately low. Sapling regeneration is only present on some sites. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of

physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

There is also an attraction for thermal foraging and bedding on south slopes and bedrock exposure. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low to high by oak diameter (size class)

- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Carex inops (long-stoloned sedge) enhances later-season aesthetics by remaining green into the summer. *Ranunculus occidentalis* (western buttercup), present in moderate amounts gives early-season appeal with its flowering. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch), present in small to moderate amounts, provide later-season appeal with their flowering.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: moderately high

Restoration Potential: very high

Restoration Priority: high

Special Management:

If Garry oak must be cut, coppicing could be initiated as an experimental treatment. Methods which kill the tree should not be considered. Consideration should be given to *Carex inops* (long-stoloned sedge) which has yellow (potentially vulnerable) status.

c13 Oak - *Melica subulata*

Ecosystem Description:

Frequency of Occurrence: 12 plots, frequent

Distribution: From Plots: widespread: Yellow Pt.: Flewitt Pt.; Galiano Is.: Mt. Galiano; Saltspring Is.: Mt. Maxwell; Saanich Peninsula: Mt. Doug., Thetis Lk. Pk.; western shore: Mill Hill, Lester Pearson College, Pedder Bay, Mary Hill, Rocky Point.

From Notes: Ladysmith: Woodley Range; Galiano Is.: Bluffs Pk.; Mayne Is.: Edith Pt.; Saturna Is.: Elliott Bluff; Pender Is.: Stanford Hill; Saanich Peninsula: Lone Tree Hill, Observatory Hill.

Plant Community Description: *Melica subulata* (ouiongrass) occupies all plots, and averages cover class 4. *Sanicula crassicaulis* (Pacific snakeroot) grows on all sites and

averages cover class 2 to 3. *Elymus glaucus* (blue wildrye) and *Galium aparine* (cleavers) occur on all sites and average cover class 2.

The remaining species listed are present on most sites. *Poa pratensis* (introduced Kentucky bluegrass) and *Vicia sativa* (introduced common vetch) average cover class 2. *Montia perfoliata* (perfoliate-leaved miners lettuce) averages cover class 1 to 2.

Tree Canopy/ Landscape Expression: Usually tree canopy (A) layer oaks, some have tall shrub (B1) canopy layer. Douglas-fir (Fd, *Pseudotsuga menziesii*) is present on some sites (about half) in the tree canopy (A) layer. Average cover is class 3.

Oak Characteristics: Diameters: usually small to medium, two are large;

Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Saplings are well-stocked, on average. Seedlings average lightly-stocked.

Physiognomic Type: usually Oak - Grass - Parkland (6), some Oak Woodlands (2), and others. Suggested Successional Status: Mature Edaphic Climax, a couple of stands are included which could probably be classified as Maturing Seral.

Constant Cover Value: 0.40 Adjusted Motyka Comparison: 0.66 Oak- *Poa pratensis* (c29a); 0.61 Oak - *Festuca idahoensis*: Typic subcommunity (c20); 0.49 Oak- *Elymus glaucus* (c47); 0.36 Oak- *Anthoxanthum odoratum* (c31a); 0.27 Oak- *Carex inops* (14).

Elevation: low elevation (5) or high elevation (6)

Slope: usually gentle to moderate Aspect: all, but usually south to southwest (8)

Surface Shape: often concave (6) or straight (4)

Moisture Regime: usually subxeric to permesic

Exposure: insolation (6), wind (4) Bedrock Geology: various

Surface Substrate Features: several (6) have either moderate to high bedrock exposure (class 3 or 4) (5) or moderate to high surface rocks (3)

Soil Classification: usually Orthic Sombric Brunisols (6), some Orthic Dystric Brunisols (2) and Orthic Humic Regosols (3)

Humus Classification: usually Vermimulls (8)

Depth of Ah Horizon: chiefly deep, > 25 to 35 cm(7), some shallow, 5 to 6 cm (3)

Colour of Ah Horizon: mainly dark, 10YR2/1 (6), some dark and slightly brownish (4) Depth to Bedrock: usually none in the profile, two plots have bedrock at 10 and 16 cm Surface Soil Texture: sandy loam (6) to loam (5), usually gravelly, some very gravelly (2) Percent Coarse Fragments: usually low, 10 to 40 %, in surface horizons (11), some high in subsurface horizons (70 to 85 %) (5)

Discussion:

This community is thought to occur on different types of sites than the several above. Its composition may also reflect the influence of more complete stand conditions, however. It may be one of the original communities for c29a, c4, c31a and b.

A Fir-oniongrass (*Melica subulata*) association with oak is recognized by the B.C. Ministry of Forests and the B.C. Conservation Data Centre. This unit is based on a re-sort of Roemer's *Quercus-Erythronium-Campanula* (QEC). *Melica subulata* was also among a group of dominant species in Roemer's (1972) *Quercus-Erythronium* (QE). The community represented by c13 is apparently unique to British Columbia now that it is considered to be extirpated from Washington, and has been given a RED provincial status. *Melica subulata* is considered to have been among the species characteristic of the Willamette Valley, Oregon (Franklin and Dyrness, 1973).

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderately high. Saplings are well-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of

wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.

- some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

There is also an attraction for thermal foraging and bedding on south slopes and bedrock exposure. This community has the resources of rich soils, such as earthworms, which are taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

The following are additional characteristics of a secondary physiognomic type (Oak Woodland) of this plant community:

- oak and deciduous litter
- high numbers of dead main stems.

There is additional security cover in these woodland stands. *Sanicula crassicaulis*

(Pacific snakeroot) is used as fresh sprouts by Coast deer and other grazing animals. Woodland settings should supply particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling; and the blue-listed Hutton's vireo (*Vireo huttoni*). The ability of *Melica subulata* (oniongrass) to stay green into the summer may provide suitable rearing conditions for the two generations of ringlet butterflies (*Coenonympha tullia insulana*), a "vulnerable status" species.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- very high by physiognomic type
- low to moderate by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Melica subulata (oniongrass) enhances later-season aesthetics by remaining green into the summer. *Ranunculus occidentalis* (western buttercup), present in moderate amounts gives early-season appeal with its flowering. Although introduced species, *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch), present in small to moderate amounts, provide later-season appeal with their flowering. *Montia perfoliata* (perfoliate-leaved miners lettuce), present in small to moderate amounts, is edible, and could be eaten for enjoyment on unpolluted sites. *Galium aparine* (cleavers) has cultural heritage value for its historic use in aboriginal technology.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: moderately high

Restoration Potential: very high

Restoration Priority: high

Special Management: Silviculture treatments should be applied to control Douglas-fir

encroachment. Girdling or removal of individual fir trees and patches of shrubs will be beneficial to the maintenance of this plant community. If Garry oak must be cut, coppicing could be initiated as an experimental treatment. Methods which kill the tree should not be considered.

c15 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza*

Ecosystem Description:

Frequency of Occurrence: 9 plots, frequent

Distribution: From Plots: Duncan: Priest Pt.; Saanich Peninsula: Bear Hill, Mt. Doug., Summit Pk., Gonzales Hill, Saxe Pt., Knockan Hill. From Notes: Saanich Peninsula: Horth Hill, Uplands, Walbran Pk., Songhees-Craigflower; western shore: Pedder Bay.

Plant Community Description: *Holodiscus discolor* (oceanspray) thrives on most sites in the low shrub (B2) layer, and on some sites in the tall shrub (B1) layer. Cover averages class 2 and 2 to 3, respectively. *Polypodium glycyrrhiza* (licorice fern) occupies on all sites and averages class 4 cover. *Elymus glaucus* (blue wildrye) grows on all sites, averaging class 2 cover. The remaining species are present on most sites. *Camassia leichtlinii* (great camas) averages class 2 to 3 cover. *Cytisus scoparius* (introduced broom), *Galium aparine* (cleavers), and *Dicranum scoparium* (broom moss) average cover class 2.

Tree Canopy/ Landscape Expression: primarily tree canopy (A) layer (6)

Oak Characteristics: Diameters: generally smaller diameter, 3 are medium or large;

Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Average stocking is moderate for saplings and light for seedlings.

Physiognomic Type: usually Oak - Fern - Rockland and Shrub Oak - Rock Outcrop (3). **Suggested Successional Status:** Mature Edaphic Climax

Constant Cover Value: 0.49 **Adjusted Motyka Comparison:** 0.33 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadelphus triquetrus* (c10); 0.10 Oak

-*Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (thickets) (c8)

Elevation: various Slope: usually moderate to moderately steep

Aspect: west (north) to east Surface Shape: various

Moisture Regime: usually xeric to very xeric, some are submesic (2) or permesic (2)

Exposure: none Bedrock Geology: usually granitic (7)

Surface Substrate Features: all plots have either moderate to very high (class 3 to 6) bedrock exposure (6) or moderate to high (class 3 or 4) surface rocks (4)

Soil Classification: chiefly Orthic Regosols Humus Classification: mainly Orthi Rhizomulls Depth of Ah Horizon: primarily shallow (4 to 14 cm)

Colour of Ah Horizon: generally dark, 10YR2/1 (6) Depth to Bedrock: normally shallow, 4 to 18 cm Surface Soil Texture: usually silt loam (6)

Percent Coarse Fragments: various

Comments: *Polypodium glycyrrhiza* (licorice fern) dies back in the late spring and resumes growth again in the late summer. This type was not detected out on the Gulf Islands.

Discussion:

One distinguishing factor is the absence of c15 from the Gulf Islands. This may be controlled by greater deer grazing pressure. Other factors are the soil classification as Orthic Regosols, reflecting the shallow *Ah* horizons and shallow soil over bedrock; the high surface exposure of granitic bedrock and the occurrence on northerly- facing slopes. None of the introduced communities are thought to be derived from the four moist shrub communities. This reflects their greater resiliency to invasion, and the fact that the most disturbed stands, such as those with Ivy, were not included for sampling.

There are no types classified for these species in the literature on oak woodlands. Both McMinn et al.(1976) and Pojar (1980a) used *Holodiscus discolor* and *Symphoricarpos albus* in their characterization of the B.C. stands. An Oak-Ocean Spray association was recognized in the B.C. Ministry of Forests Ecology Program's

re-sorting of Roemer's (1972) data. A biogeocoenose was recognized partly for *Symphoricarpos* and *Quercus* by Krajina (1969).

Communities noted for *Holodiscus discolor* are well represented across the geographic range: Galiano, Saturna, Mayne and smaller islands (Pattison and Karanka, 1981; Janszen, 1977; 1981); western Washington (Atkinson and Sharpe, 1985, Taylor and Boss, 1975); the Willamette Valley of Oregon (Thilenius, 1964); and northern California (Kuchler, 1977), including the Bald Hills oak woodlands (Sugihara et al., 1987). *Holodiscus discolor* and *Symphoricarpos albus* were among a group of dominant species in the *Quercus-Erythronium (QE)* and were among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). These shrubs were not confined to the *Quercus* vegetation in Roemer's classification which is based on the presence or absence of species. Both species did have a moderately strong dominance in the *Quercus* communities though. The U.S. classifications are based on dominance rather than presence, and tend to use these species to define plant communities.

Holodiscus discolor partly dominated the shrub layer on rocky stream channels in the *Philadelphus/Cystopteris* community described for the Bald Hills oak woodlands of California by Sugihara et al. (1987). *Polypodium glycyrrhiza* was well represented. A *Quercus/Symphoricarpos* community was described from dense young mesic stands from the same area. A *Holodiscus discolor* community was described by Kertis (1986) for the Oak Patch reserve near Bremerton, Washington. Dominance by ocean spray was noted by Sharpe (in prep.) for the Puget Sound prairies. The species was common in the open transitional forest on the San Juan Islands (Atkinson and Sharpe, 1985). Kuchler (1977) included *Holodiscus discolor* in his list of characteristic components for the Oregon white oak map unit for California. On Galiano, Valdes and Thetis Islands, Ocean spray was common in one vegetation unit with Garry Oak, and one without (Pattison and Karanka, 1981). *Holodiscus discolor* partly defined a plant community from the Willamette Valley (Thilenius, 1964) and was a common shrub in three communities (Thilenius, 1968). Taylor and Boss (1975)

mentioned the occurrence of the species from Oakville, Grays Harbour, Washington, associated with a wet oak-- Douglas-fir -- western hemlock forest. *Holodiscus discolor* partly dominated the shrub layer on rocky stream channels in the *Philadelphus/Cystopteris* community described for the Bald Hills oak woodlands of California by Sugihara et al. (1987).

A *Quercus/Amelanchier/Symphoricarpos* community was described by Thilenius (1964, 1968) from the Willamette Valley, Oregon. Similar types, emphasizing snowberry, occur in the Saanich Peninsula (Roemer, 1972, Pojar, 1980b) and the Capital Regional District (McMinn et al., 1976); on Galiano, Valdes, and Thetis Islands (Pattison and Karanka, 1981); on Saturna and Mayne Islands (Janszen, 1977; 1981); in the open transitional forest on the San Juan Islands (Atkinson and Sharpe, 1985); on the Oak Patch reserve, near Bremerton, Washington (Kertis, 1986); in the Washougal River Valley, Clark County, and in Oakville, Grays Harbour County, Washington (Taylor and Boss, 1975); in the Badger allotment of Mt. Hood National Forest, Oregon (Williams (1978: *S.mollis* though); and in the Bald Hills oak woodlands of Redwood National Park (Sugihara et al., 1987).

Snowberry's dominance may have been much lower in pre-European times, when burning was a periodic feature of the plant communities. Snowberry's abundance may also reflect the negative forage selection effects of domestic sheep (Douglas, 1993, pers.comm.). Nonetheless, *Symphoricarpos albus* was the seventh most frequent species (1993) and had the second highest total cover (both years), and is the best candidate, along with *Elymus glaucus*, for naming a *Quercus garryana* Alliance. If used in the name, a qualification should be made explaining that there was actually a tension between this shrub and the herbs, with less *Symphoricarpos albus* than at present under a natural fire and deer browsing regime.

There is a discussion of *Camassia leichtlinii* in c37a and c36.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderate. Current regeneration is normal.

Wildlife Habitat and Use: Most stands have the physiognomic type, Oak- Fern Rockland, with the following characteristics:

- seeds, foraging space, grasshoppers, fresh sprouts, nectar
- thermal and visual security bedding, escape terrain
- rock crevices

Some stands have the following additional physiognomic type characteristics (Shrub oak- Rock outcrop):

- indications of high utilization, high average numbers of wildlife use and wildlife habitat attributes, high numbers of bedrock and rock crevices and burrows.
- potential for attracting chaparral species
- increased food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- high total numbers of tree wildlife habitat features, high numbers of: perches, loose bark occurrences, scaling limbs, small and medium dead limbs.

Some sites have large tree attributes, such as: bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Holodiscus discolor (oceanspray) is of moderate importance as winter forage for Coast deer. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus*

fuscus) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling.

Holodiscus discolor (oceanspray) is a larval food for spring azure (*Celastrina ladon*) and Lorquin's admiral (*Basilarchia lorquini*) butterflies, and the brightly coloured sheep moth (*Hemileuca eglanteria*). *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, probably for butterflies and is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high, based on the following:

- moderately high by physiognomic type
- mostly low, with some moderate to high, by oak diameter (size class)
- high by form-class within physiognomic type
- low to moderately high by oak form-complexity within physiognomic type

Aesthetic and interest value are added to this plant community because of the phenology of *Polypodium glycyrrhiza* (licorice fern) and the showy late-season flowers of ocean spray. Licorice fern dies back in the late spring and resumes growth again in the late summer, remaining green all through the winter and early spring. *Camassia leichtlinii* (great camas), present in moderate to substantial amounts, gives early-season appeal with its flowering and interest value with its seed heads. Camas and *Polypodium glycyrrhiza* (licorice fern) have cultural heritage value for their historic aboriginal food use, ocean spray and snowberry for their medicinal use, ocean spray also for its technological use.

Susceptibility to Disturbance: very high

Prescribed Fire: The potential and need for the use of prescribed fire is low and often not advisable.

Threats: high

Restoration Potential: very high

Restoration Priority: moderately high

Special Management:

Polypodium glycyrrhiza (licorice fern) and *Holodiscus discolor* (oceanspray) are cultivated for native plant gardening.

c10 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadelphus triquetrus*

Ecosystem Description:

Frequency of Occurrence: 5 plots, infrequent to moderately frequent

Distribution: From Plots: Duncan: Mt. Tzuhalem, Priest Pt.; Saanich Peninsula: Water Tower Hill, Mt. Finlayson, Thetis Lk. Pk. From Notes: Ladysmith: Woodley Range; Cowichan Valley, Mt. Tzuhalem, Dunsmuir Lodge, Skirt Mt., Beaver Lake, Marigold Pk.

Plant Community Description: *Holodiscus discolor* (oceanspray) prospers on all sites and averages high cover, class 5, in the tall shrub (B1) layer. *Symphoricarpos albus* (snowberry) occurs on all sites in the low shrub (B2) layer, averaging class 3 cover. *Rhytidiadelphus triquetrus* (electrified cat's-tail moss) occupies all sites, with an average class 3 cover.

Sanicula crassicaulis (Pacific snakeroot), *Galium aparine* (cleavers), *Carex inops* (long-stolonated sedge), and *Arenaria macrophyllum* (large-leaved sandwort) are present on all sites and average cover class 2,2,1 to 2, and 1, respectively.

The remaining species exist on most sites. *Erythronium oregonum* (easter lily) averages cover class 2. *Mahonia aquifolium* (tall oregon-grape), *Cytisus scoparius* (introduced broom), and *Bromus carinatus* (California bromegrass) average class 1

to 2. *Elymus glaucus* (blue wild-rye), *Dactylis glomerata* (introduced orchardgrass), *Vicia americana* (American vetch), *Fritillaria lanceolata* (chocolate lily), and *Stellaria media* (introduced chickweed) average cover class 1.

Tree Canopy/ Landscape Expression: tree canopy (A) layer oak. Douglas-fir (Fd, *Pseudotsuga menziesii*) is present as an A layer tree on most sites, and on sites some in the tall shrub layer. Cover is small, averaging class 2 for the former and class 1 for the latter.

Oak Characteristics: Diameters: mostly small (one is large);

Regeneration: Regeneration is present for saplings on most sites and for seedlings on all sites. Stocking is moderate to well-stocked for saplings and lightly-stocked for seedlings.

Physiognomic Type: various: some Oak - Dense Shrub (2).

Suggested Successional Status: usually Mature Edaphic Climax, one Young Edaphic Climax, one Maturing Seral stand

Constant Cover Value: 0.54 Adjusted Motyka Comparison: 0.33 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza* (c15); 0.27 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (thickets) (c8)

Elevation: low (2) to high (3) elevation Slope: gentle (one steep)

Aspect: east (south) to west Surface Shape: various: concave (2), variable (2)

Moisture Regime: submesic to permesic Exposure: none for most (3), insolation (2)

Bedrock Geology: ordinarily coarse: granitic, gneiss

Surface Substrate Features: most (3) have moderate to high (class 3 to 5) bedrock exposure Soil Classification: generally Orthic Sombric Brunisols (4)

Humus Classification: Vermimulls Depth of Ah Horizon: commonly > 25 to 30 cm, or 4 to 10 cm Colour of Ah Horizon: mostly dark (3), some dark and brownish (2)

Depth to Bedrock: none

Surface Soil Texture: loam to silt loam, usually very gravelly (3) or gravelly (1)

Percent Coarse Fragments: usually high (50 to 70%) (4)

Comments: These sites are receiving additional moisture from the surrounding

landscape, as indicated by the toe (2), concave or slightly concave positions (2), and observations of seepage below one site. One plot was without these indicators. Some of these sites are shrub thickets.

Discussion:

This community is partly distinguished by its absence from the Gulf Islands. These sites are unique in their signs of seepage. See the community discussion in c15. This community would probably degrade to ivy and blackberry stands with increasing disturbance.

A biogeocoenose was recognized partly for *Rhytidiadelphus*, *Symphoricarpos* and *Quercus* by Krajina (1969). *Rhytidiadelphus triquetrus* was typical of exposed bedrock areas with Garry Oak on the Shallow Soil landscape unit described by Oswald (1977) from Gabriola Island. *Arenaria macrophylla* was among a group of dominant species in the *Quercus-Erythronium (QE)* of Roemer (1972). There are discussions of *Symphoricarpos albus* and *Holodiscus discolor* under c15 and *Carex inops* in c14.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is high. Seedling regeneration was present on all sites. Saplings were moderately well- to well- stocked. Otherwise normal.

Wildlife Habitat and Use: Stands have the physiognomic type Oak- Dense Shrub with the following characteristics:

- dense hiding and security cover
- oak and deciduous litter
- some trees with medium and large tree attributes: bark glean, foliage glean, perching, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows

There are resources of rich soils, such as earthworms. Both *Holodiscus discolor*

(oceanspray) and *Mahonia aquifolium* (tall Oregon grape) which is present in small to moderate amounts, are moderately important as winter forage for Coast deer. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by Coast deer and other grazing animals. This sites of this community should provide habitat for northwestern garter snakes (*Thamnophis ordinoides*), with exposed bedrock and the dense shrubs occasionally thicketed. The shrubs of this community provide the dense cover required by birds such as dark-eyed junco (*Junco hyemalis*), orange crowned warbler (*Vermivora celata*) and rufous sided towhee (*Pipilio erythrophthalmus*). The oak and deciduous litter provides ideal ground feeding opportunities for rufous-sided towhee. Large trees in deciduous bottomland provide habitat for Pacific-slope flycatcher (*Empidonax difficilis*), the fifth most frequent bird species in my 1993 sampling. *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies.

Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Erythronium oregonum* (easter lily), present in moderate amounts, provides nectar for *Incisalia mossii* (moss elfin), a blue-listed butterfly. *Holodiscus discolor* (oceanspray) is a larval food for spring azure (*Celastrina ladon*) and Lorquin's admiral (*Basilarchia lorquini*) butterflies, and the brightly coloured sheep moth (*Hemileuca eglantheria*). *Vicia americana* (American vetch) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), western tailed blue (*Everes amyntula*), and the endangered greenish blue (*Plebejus saepiolus insulanus*), all of which use *Vicia*. So also would western sulphur (*Colias occidentalis occidentalis*), were this butterfly not extirpated from the Garry oak areas. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately, based on the following:

- low, with some moderate and very high, by physiognomic type
- mostly low by oak diameter (size class)
- moderately high by form-class within physiognomic type
- moderately low by oak form-complexity within physiognomic type

Aesthetic appeal of the plant community is elevated because of the showy late-season flowers of ocean spray, the early-season flowers of snowberry, and its white waxy berries persisting into winter. *Mahonia aquifolium* (tall Oregon grape), present in small to moderate amounts, adds appeal and interest value with its evergreen leaves, sometimes showy green, sometimes red; yellow, fragrant flowers and blue berries, which are also edible. Tall Oregon grape has cultural heritage value for its historic aboriginal food, technology, and medicinal use, ocean spray and snowberry for their medicinal use, ocean spray also for its technological use. *Carex inops* (long-stoloned sedge), present in moderate amounts, enhances later-season aesthetics by remaining green into the summer. *Erythronium oregonum* (easter lily), *Fritillaria lanceolata* (chocolate lily), *Vicia americana* (American vetch), and *Arenaria macrophyllum* (large-leaved sandwort), present in small or moderate amounts, add appeal with their sequential flowering through the growing season. *Fritillaria lanceolata* (chocolate lily) has cultural heritage value for its historic aboriginal food use.

Susceptibility to Disturbance: high

Prescribed Fire: The potential and need for the use of prescribed fire is low, for maintenance of this type. However, the potential and need is high for converting a portion into native herbaceous types.

Threats: moderately high

Restoration Potential: very high

Restoration Priority: moderately high

Special Management: Silviculture treatments should be applied to control Douglas-fir encroachment. Girdling or removal of individual fir trees and patches of shrubs will be beneficial to the maintenance of this plant community. If Garry oak must be cut, coppicing could be initiated as an experimental treatment. Methods which kill the

tree should not be considered. Any burning plans should consider the conflict with populations of western tailed blue (*Everes amyntula*), which winter in *Lathyrus* and *Vicia* seedpods. Consideration should be given to *Piperia elegans* (*Platanthera unalascensis ssp. elata*), a species with yellow (potentially vulnerable) status, which this community seems to provide habitat for. *Rhytidiadelphus triquetrus* (electrified cat's-tail moss) is used in floral displays. Tall Oregon grape and *Fritillaria lanceolata* (chocolate lily) are cultivated and used in native plant gardening.

c8 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (thickets)

Ecosystem Description:

Frequency of Occurrence: 11 plots, frequent

Distribution: From Plots: widespread: Gulf Islands: Cabbage Is.; Saturna Is.: East Pt.; Galiano Is.: Dionisio Pt.; Saltspring Is.: Ruckle Pt.; Saanich Peninsula: Tsubhem Harbour, Uplands, Songhees, Knockan Hill; western shore: Juan de Fuca Pk.

From Notes: Nanaimo: Jack Pt.; Yellow Pt.: s. of Joan Pt., n. of Boathouse Harbour; Thetis Lk. Pk., Saxe Pt.

Plant Community Description: *Symphoricarpos albus* (snowberry) occupies all sites, averaging cover class 4 in the low shrub (B2) layer. *Rosa nutkana* (nootka rose) occurs on most sites in the low shrub (B2) layer, and some sites in the tall shrub (B1) layer. Cover averages class 3 for the former, and class 2 for the latter. *Lonicera ciliosa* (orange honeysuckle) grows as a low shrub (B2 layer) on all sites, and as a tall shrub (B1) on most sites. Average covers are class 3 and 2, respectively.

The remaining species listed are present on most sites. *Dactylis glomerata* (introduced orchardgrass) averages class 2 to 3. *Elymus glaucus* (blue wildrye), *Poa pratensis* (introduced Kentucky bluegrass), and *Galium aparine* (cleavers) average cover class 2. *Vicia sativa* (introduced common vetch) averages cover class 1 to 2.

Tree Canopy/ Landscape Expression: tree canopy (A) layer (A), chiefly high cover (class 5 or 6) (7)

Oak Characteristics: Diameters: mainly small to medium, two are large;

Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Stocking is moderately- to well-stocked for saplings, and light for seedlings.

Physiognomic Type: usually Oak - Shrub - Thicket (6 or 7), some Oak -Dense Shrub (2), and others. Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.47 Adjusted Motyka Comparison: 1.64 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity (thickets (c9); 0.27 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadelphus triquetrus* (c10).

Elevation: usually low elevation (10), one is medium elevation

Slope: usually gentle (0 to 20 %) Aspect: all

Surface Shape: usually straight (5) or concave (4)

Moisture Regime: usually submesic to subhygric

Exposure: some wind (6), seaspray (6), and insolation (5)

Bedrock Geology: usually coarse: granitic or sandstone (7)

Surface Substrate Features: several (4) with either moderate to high bedrock exposure (class 3 to 4) (3) or moderate to high (class 3 to 5) surface rocks (3), some with moderate to high (class 3 to 4) surface dead wood (3)

Soil Classification: primarily Orthic Sombric Brunisols

Humus Classification: Vermimulls Depth of Ah Horizon: usually deep: > 20 to 30 cm

Colour of Ah Horizon: usually dark, 10YR2/1 Depth to Bedrock: typically none

Surface Soil Texture: generally silt loam to loam (10), gravelly or very gravelly subsurface horizons Percent Coarse Fragments: various

Comments: Often near the sea-edge. These sites are multi-layered shrub thickets.

Discussion:

Along with c9, this plant community occupies gentle slopes on all aspects at low elevations and has deep dark-coloured *Ah* horizons. These factors

partly distinguish it. See the community discussion in c15 and c10. The distribution and development of c8 seems to be inversely related to deer populations, and possibly to livestock as well.

Communities such as c8 are not described from the literature. However, there are structural characteristics, such as the shrub thickets and the prominence of woody vines (lianas), shared by communities such as the *Quercus garryana*/*Fraxinus latifolia*/*Rosa eglantheria*/*Juncus effusus* association (Smith 1985) of the Umpqua basin, Oregon. This was a riparian woodland related to a number of other Washington and Oregon stands. Lianas such as *Marah oregonus* and *Rhus diversiloba* are characteristic, switching over to the valley oak woodlands in California, where they are joined by *Vitis californica*. *Lonicera ciliosa* is the main liana of c8, but is joined by *Lonicera hispidula*, and on a couple of sites by the introduced *Hedera helix*. *Lonicera ciliosa* was a principal species of a non-oak forested community on Sucia Island, Washington (Fonda and Bernardi, 1976). There is a discussion of *Symphoricarpos albus* in c15.

Interpretations:

Preservation Priority: very high by general ranking

Regeneration: Regeneration potential is moderate. Current regeneration is normal.

Wildlife Habitat and Use: Most stands have the following physiognomic type characteristics (Oak- Shrub Thicket):

- the shrubs furnish dense, low cover for hiding and security
- berries, nectar
- oak and deciduous litter

Some stands have the physiognomic type, Oak- Dense Shrub, with the following additional characteristics:

- some trees with medium and large tree attributes: bark glean, foliage glean, perching, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows

There are resources of rich soils, such as earthworms. Both *Rosa nutkana* (nootka

rose) and *Mahonia aquifolium* (tall Oregon grape) which is present in small to moderate amounts, are moderately important as winter forage for Coast deer. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. The sites of this community should provide habitat for northwestern garter snakes (*Thamnophis ordinoides*), with dense shrub thickets and occasional exposed bedrock or rocks. This rockiness combined with the high dead wood in the surface substrate of the sites may give habitat opportunities for the red-listed sharp-tailed snake (*Contia tenuis*), especially out on the Gulf Islands, as well as amphibians such as long-toed salamanders (*Ambystoma macrodactylum*) and wandering shrews (*Sorex vagrans isolatus*, *S.v.vancouverensis*).

The shrubs of this community, *Symphoricarpos albus* (snowberry), *Rosa nutkana* (nootka rose), *Lonicera ciliosa* (orange honeysuckle) and *Mahonia aquifolium* (tall Oregon grape), are a rich source of berries for birds such as cedar waxwing (*Bombycilla cedrorum*) and American robin (*Turdus migratorius*), as well as mammals. The shrubs of this community provide the dense cover required by birds such as dark-eyed junco (*Junco hyemalis*), orange crowned warbler (*Vermivora celata*) and rufous sided towhee (*Pipilio erythrophthalmus*). The oak and deciduous litter provides ideal ground feeding opportunities for rufous-sided towhee (*Pipilio erythrophthalmus*). Large trees in deciduous bottomland provide habitat for Pacific-slope flycatcher (*Empidonax difficilis*), the fifth most frequent bird species in my 1993 sampling. All three shrubs are noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Rufous-sided hummingbird is the main pollinator for this honeysuckle. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Erythronium oregonum* (easter lily), present in moderate amounts, provides nectar for *Incisalia mossii* (moss elfin), a blue-listed butterfly.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high, based on the following:

- low to high by physiognomic type

- mostly low to moderate by oak diameter (size class)
- moderately high by form-class within physiognomic type
- low to moderately low by oak form-complexity within physiognomic type

Aesthetic appeal of the plant community is elevated because of the value of the edges, the interesting diversity of shrub growth, especially the climbing liana forms, the showy late-season honeysuckle flowers, and the butterflies and hummingbirds they attract. The showy and fragrant late-season Nootka rose flowering, snowberry's flowers and white waxy berries add to this appeal, especially in combination with the red of rosehips in winter. The delicate leafing-out of snowberry in early spring is another feature. Nootka rose and tall Oregon grape have cultural heritage value for its historic aboriginal for their food, medicinal and technological use, tall Oregon grape for its medicinal use.

Susceptibility to Disturbance: moderate.

Prescribed Fire: The potential and need for the use of prescribed fire is low.

Threats: very high

Restoration Potential: very high

Restoration Priority: moderately high

Special Management:

Eradication of *Hedera helix* (ivy) and possibly *Daphne laureola* (introduced daphne) will be required. The "threats" rating above was elevated because of the danger of clearing associated with trails where this community and c9 occur. The safety concerns behind clearing initiatives should be resolved without sacrificing this community. Alternatives such as fencing are more reasonable, considering this is an endangered plant community. At UVIC landscaping practices have decimated this community. This is a good opportunity for the academic institution to show leadership, especially since snowberry, Nootka rose and orange honeysuckle are cultivated and used in native plant gardening.

c9 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity (thickets)

Ecosystem Description:

Frequency of Occurrence: 10 plots, frequent

Distribution: From Plots: Yellow Point: Reynolds Pt.; Saanich Peninsula: Water Tower Hill, UVIC, Uplands, Anderson Hill Pk., Beacon Hill Pk., Naden Hill, Panama Hill, Thetis Lk. Pk. From Notes: Yellow Pt.: Sharpe Pt.; Gabriola Is.: False Narrows; Songhees- Craigflower, Marigold Pk.

Plant Community Description: *Symphoricarpos albus* (snowberry) thrives on all sites, averaging high cover, class 4, in the low shrub (B2) layer. *Rosa nutkana* (nootka rose) occupies most sites in the low shrub (B2) layer and some sites in the tall shrub (B1) layer. The former cover averages class 3 and the latter class 2 to 3. *Oemleria cerasiformis* (osoberry) occurs on most sites in the tall shrub (B1) layer and some sites in the low shrub (B2) layer. Cover averages class 3 in the taller layer and class 2 to 3 in the lower. *Daphne laureola* (introduced daphne) grows most sites in the low shrub layer (B2), and averages cover class 1 to 2. *Dactylis glomerata* (introduced orchardgrass) is present on most sites and averages cover class 2.

Tree Canopy/ Landscape Expression: usually high cover (class 5 or 6) tree canopy (A) layer (6)

Oak Characteristics: Diameters: various; Regeneration: Saplings are regenerating on most sites, seedlings on some sites. Stocking averages moderate to well-stocked for saplings, and (very) light for seedlings.

Physiognomic Type: usually Oak - Shrub- Thicket (8 or 9).

Suggested Successional Status: Mature Edaphic Climax

Constant Cover Value: 0.50 Adjusted Motyka Comparison: 1.64 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (thickets) (c8); 0.0 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza* (c15)

Elevation: mostly low elevation Slope: usually gentle slopes

Aspect: various Surface Shape: usually straight (6) Moisture Regime: mesic to

subhygric

Exposure: several, including wind (4), cool air (2), seaspray (2)

Bedrock Geology: various Surface Substrate Features: ordinarily without features, some (4) moderately high (class 3) surface dead wood

Soil Classification: usually Orthic Sombric Brunisols

Humus Classification: Orthi Vermimulls

Depth of Ah Horizon: usually deep, > 20 to 30 cm

Colour of Ah Horizon: normally dark, 10YR2/1 Depth to Bedrock: none

Surface Soil Texture: silt loam to loam Percent Coarse Fragments: low: 0 to 40 %

Comments: These sites are multi-layered shrub thickets.

Discussion:

This plant community, along with c8, occupies gentle slopes on all aspects at low elevations and has deep dark-coloured *Ah* horizons. These factors partly distinguish it. The discussion of derivations in c15m c10 and c8 also applies to this community.

Oemleria cerasiformis was well represented in the *Philadelphus/Cystopteris* community found on rocky stream channels in the Bald Hills oak woodlands of California by Sugihara et al. 1987). Both *Philadelphus lewisii* and *Holodiscus discolor*, found on some sites in c9, dominated the shrub layer.

Communities such as c9 are not described from the literature. However, the shrub thickets are a structural characteristic shared by communities such as the *Quercus garryana/Fraxinus latifolia/Rosa eglantheria/Juncus effusus* association (Smith 1985) of the Umpqua basin, Oregon. This was a riparian woodland related to a number of other Washington and Oregon stands. There is a discussion of *Symphoricarpos albus* in c15.

Interpretations:

Preservation Priority: very high by general ranking.

Regeneration: Regeneration potential is moderate, when balanced between the classes. Seedlings are only present on some sites and their stocking is only very light. Sapling stocking is above average: moderately well- to well- stocked, but are otherwise normal.

Wildlife Habitat and Use: Most stands have the following physiognomic type characteristics (Oak- Shrub Thicket):

- the shrubs furnish dense, low cover for hiding and security
- berries, nectar
- oak and deciduous litter

Some trees and stands have large tree attributes: bark glean, foliage glean, perching, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

There are resources of rich soils, such as earthworms. *Rosa nutkana* (nootka rose) is of moderate importance as winter forage for Coast deer. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. The dense shrub thickets of this community may provide habitat for northwestern garter snakes (*Thamnophis ordinoides*). The high dead wood in the surface substrate of the sites may give habitat opportunities for the red-listed sharp-tailed snake (*Contia tenuis*), although the community was only detected on Gabriola Island, of the Gulf Islands, as well as habitat for amphibians such as long-toed salamanders (*Ambystoma macrodactylum*) and wandering shrews (*Sorex vagrans isolatus*, *S.v.vancouverensis*).

Large trees in deciduous bottomland provide habitat for Pacific-slope flycatcher (*Empidonax difficilis*), the fifth most frequent bird species in my 1993 sampling. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow

(*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions.

The shrubs of this community, *Symphoricarpos albus* (snowberry), *Rosa nutkana* (nootka rose) and *Oemleria cerasiformis* (osoberry) are a rich source of berries for birds, cedar waxwing (*Bombycilla cedrorum*) and American robin (*Turdus migratorius*), as well as mammals. The shrubs of this community provide the dense cover required by birds such as dark-eyed junco (*Junco hyemalis*), orange crowned warbler (*Vermivora celata*) and rufous sided towhee (*Pipilo erythrophthalmus*). Osoberry provides early spring nectar for rufous and Anna's hummingbird. The other two shrubs are also noted nectar producers for hummingbirds and probably butterflies as well. The oak and deciduous litter provides ideal ground feeding opportunities for rufous-sided towhee (*Pipilo erythrophthalmus*). Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high to high, based on the following:

- low to very high by physiognomic type
- low to high by oak diameter (size class)
- moderately high by form-class within physiognomic type
- low by oak form-complexity within physiognomic type

Aesthetic appeal of the plant community is elevated because of the value of the edges, the interesting diversity of shrub growth and the showy and fragrant late-season Nootka rose flowers. Showy birds, such as cedar waxwings, are attracted to the fruits, especially the plums of osoberry. The early-season flowers of snowberry and white waxy berries add to this appeal, especially in combination with the red of rosehips in winter. The early spring flowering of *Oemleria cerasiformis* (osoberry) provides aesthetic appeal, especially when visited by hummingbirds. At this time, snowberry has delicate, light green foliage when leafing out. Osoberry has cultural

heritage value for its historic aboriginal food use, Nootka rose for its food, medicinal and technological use, and snowberry for its medicinal use. Osoberry is also called "Indian plum" in recognition of this use.

Susceptibility to Disturbance: moderate

Prescribed Fire:The potential and need for the use of prescribed fire is low.

Threats: very high

Restoration Potential: very high

Restoration Priority: moderately high

Special Management:

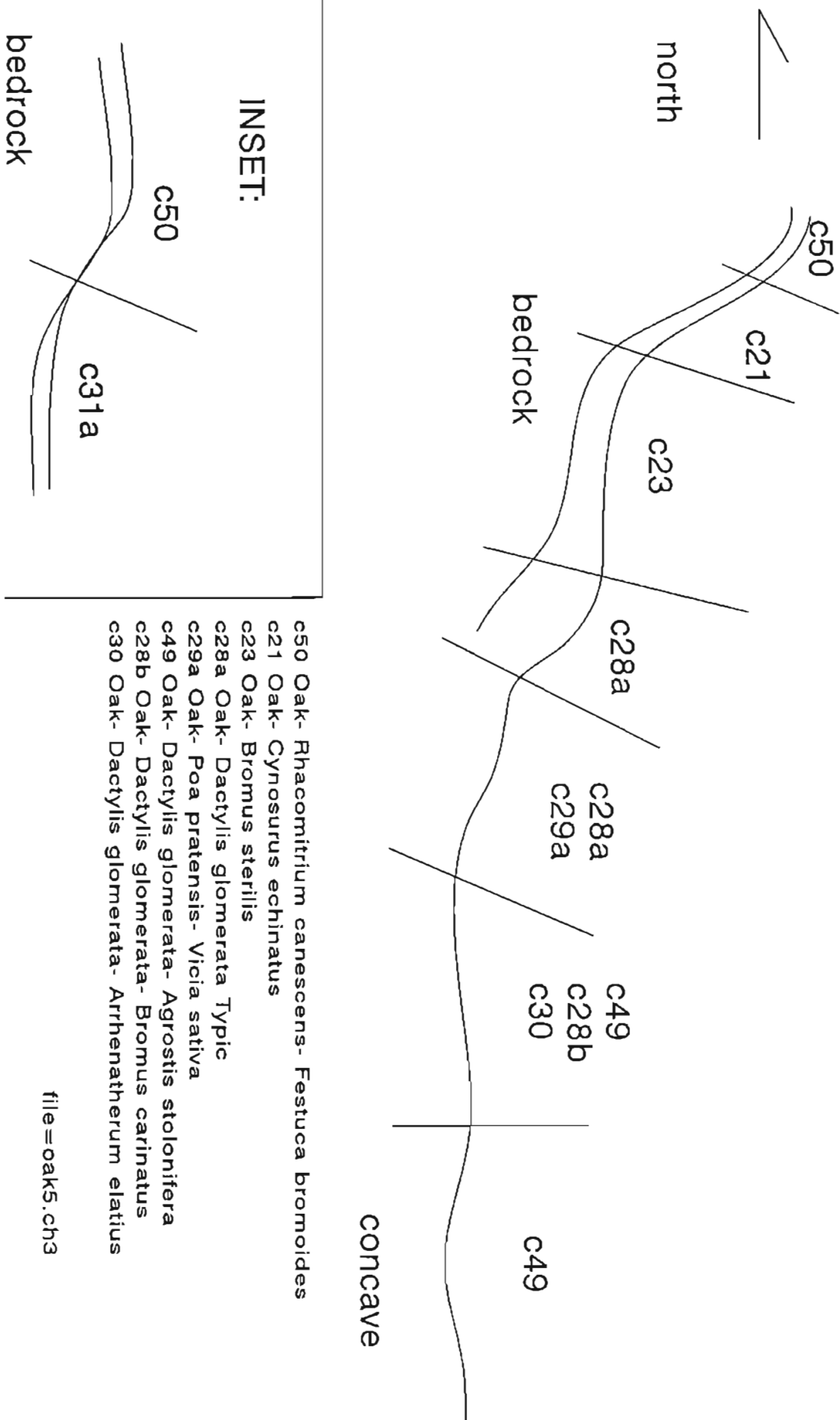
Some vegetation management may be required to achieve adequate regeneration of Garry oak. Other special management comments in c8 apply to this community.

CHAPTER 6 PLANT COMMUNITIES AND ECOSYSTEMS (1): INTRODUCED PLANT COMMUNITIES

6.0 INTRODUCTION

This chapter continues the presentation, discussion and interpretation, with the introduced plant communities (named for introduced species). It begins with the "first-order disturbance communities", with the "second-order disturbance communities" following. The terms "first-order" and "second-order" disturbance communities reflect the apparent sequence of vegetation change and site disturbance following the introduction of non-indigenous species by European colonists (see 2.5). Native plant communities (named for native plant species) are covered in the previous chapter. The plant community interpretations are intended to be used within the context of the management strategy in the Chapter 7. Generalized relationships of the introduced plant communities to the landscape (but not necessarily to each other) are illustrated in Figures 23 and 24. Based on multiple regression results and my working generalizations, a summary of the placement of the introduced plant communities by ecological moisture regime and geographic area is provided in Figures 25 to 28. This summary both supplements the ecosystem descriptions which follow and illustrates the separation or overlap in these factors. Origins and derivations of the communities are suggested in the text and summarized in Figures 20 to 22. A description of the categories used for each plant community is found in 5.1.

FIGURE 23. LANDSCAPE DIAGRAM FOR FIRST-ORDER DISTURBANCE PLANT COMMUNITIES



- INSET:
- c50 Oak- *Rhacomitrium canescens*- *Festuca bromoides*
 - c21 Oak- *Cynosurus echinatus*
 - c23 Oak- *Bromus sterilis*
 - c28a Oak- *Dactylis glomerata* Typic
 - c29a Oak- *Poa pratensis*- *Vicia sativa*
 - c49 Oak- *Dactylis glomerata*- *Agrostis stolonifera*
 - c28b Oak- *Dactylis glomerata*- *Bromus carinatus*
 - c30 Oak- *Dactylis glomerata*- *Arrhenatherum elatius*

file = oak5.ch3

FIGURE 24. LANDSCAPE DIAGRAM FOR SECOND-ORDER DISTURBANCE PLANT COMMUNITIES

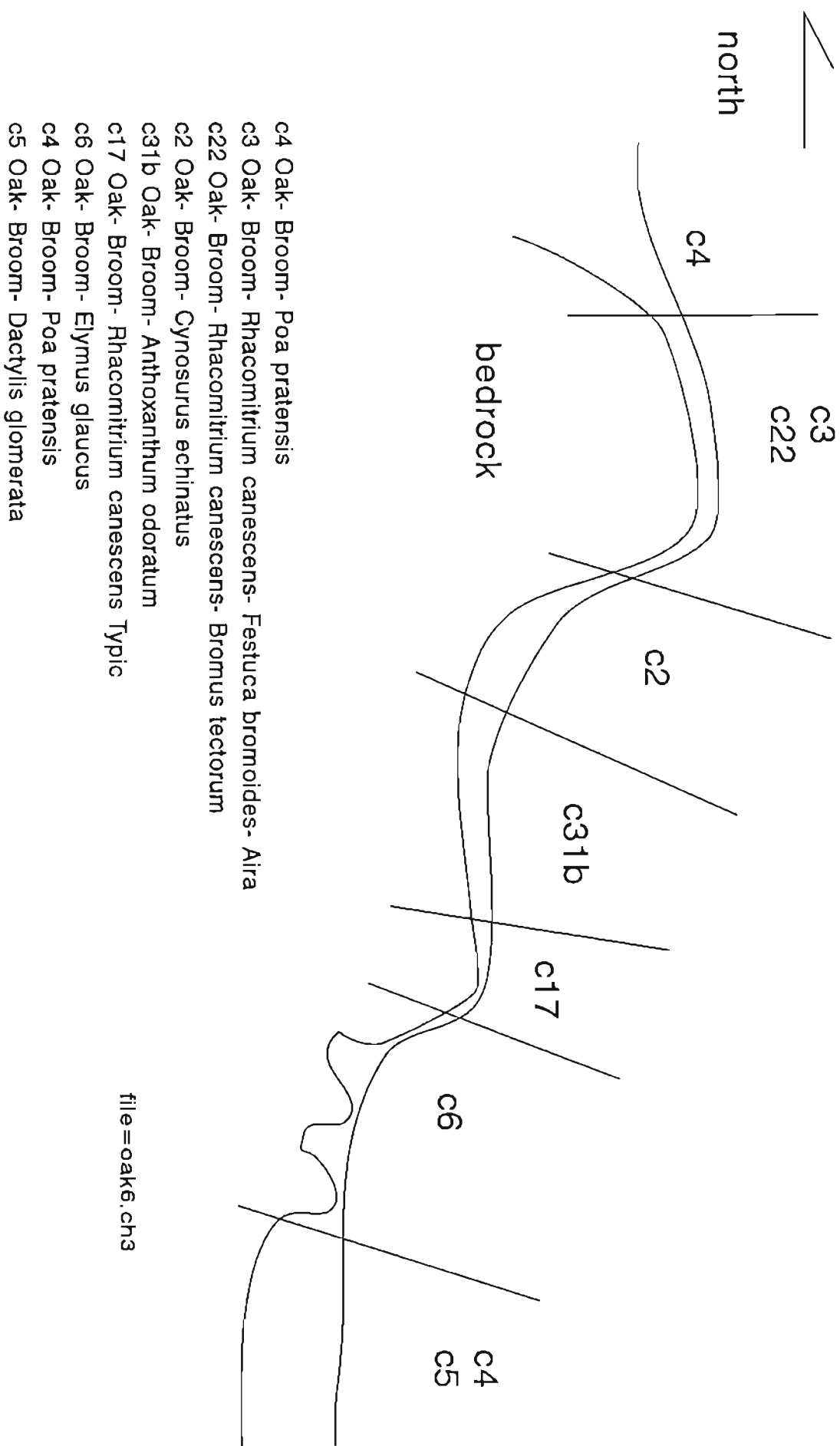
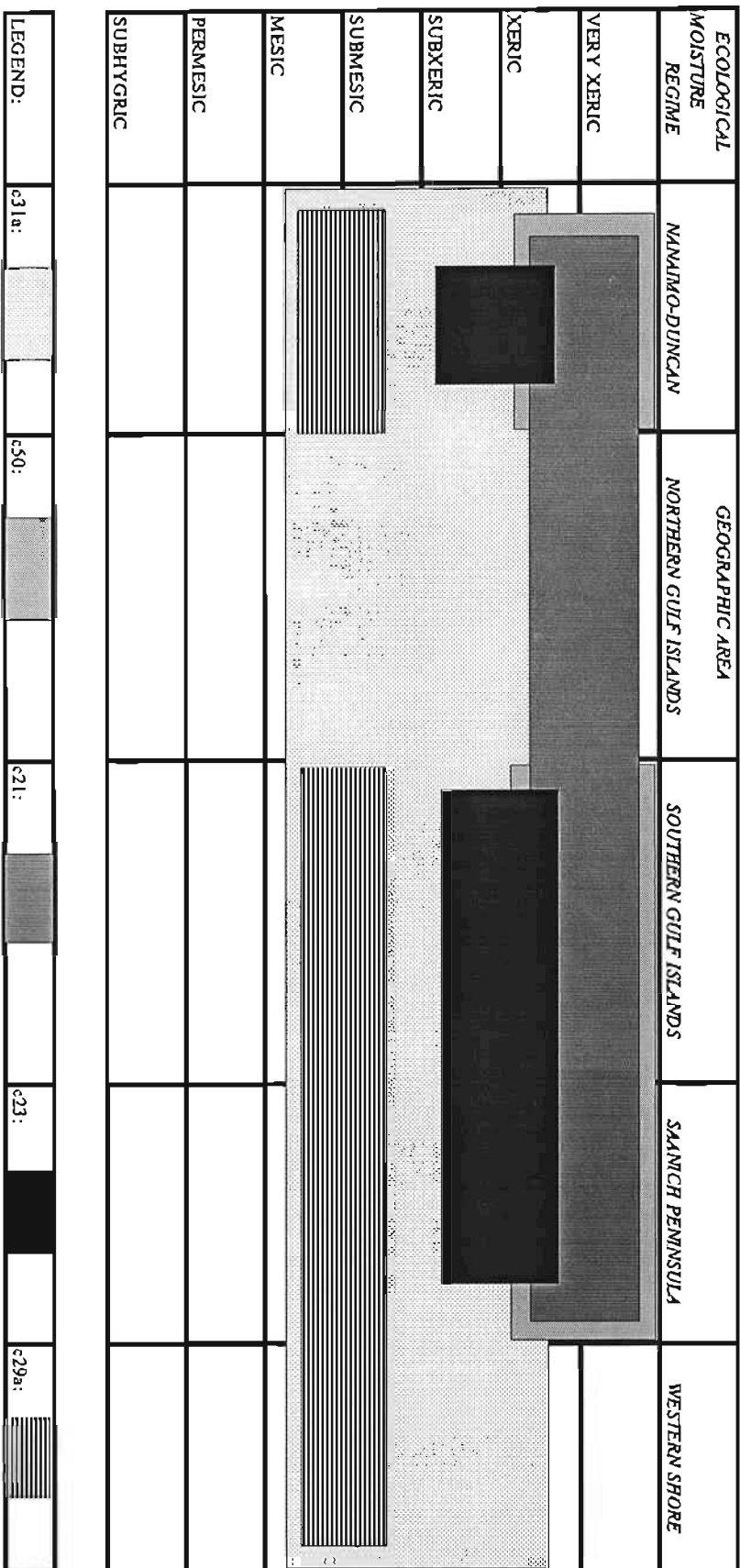


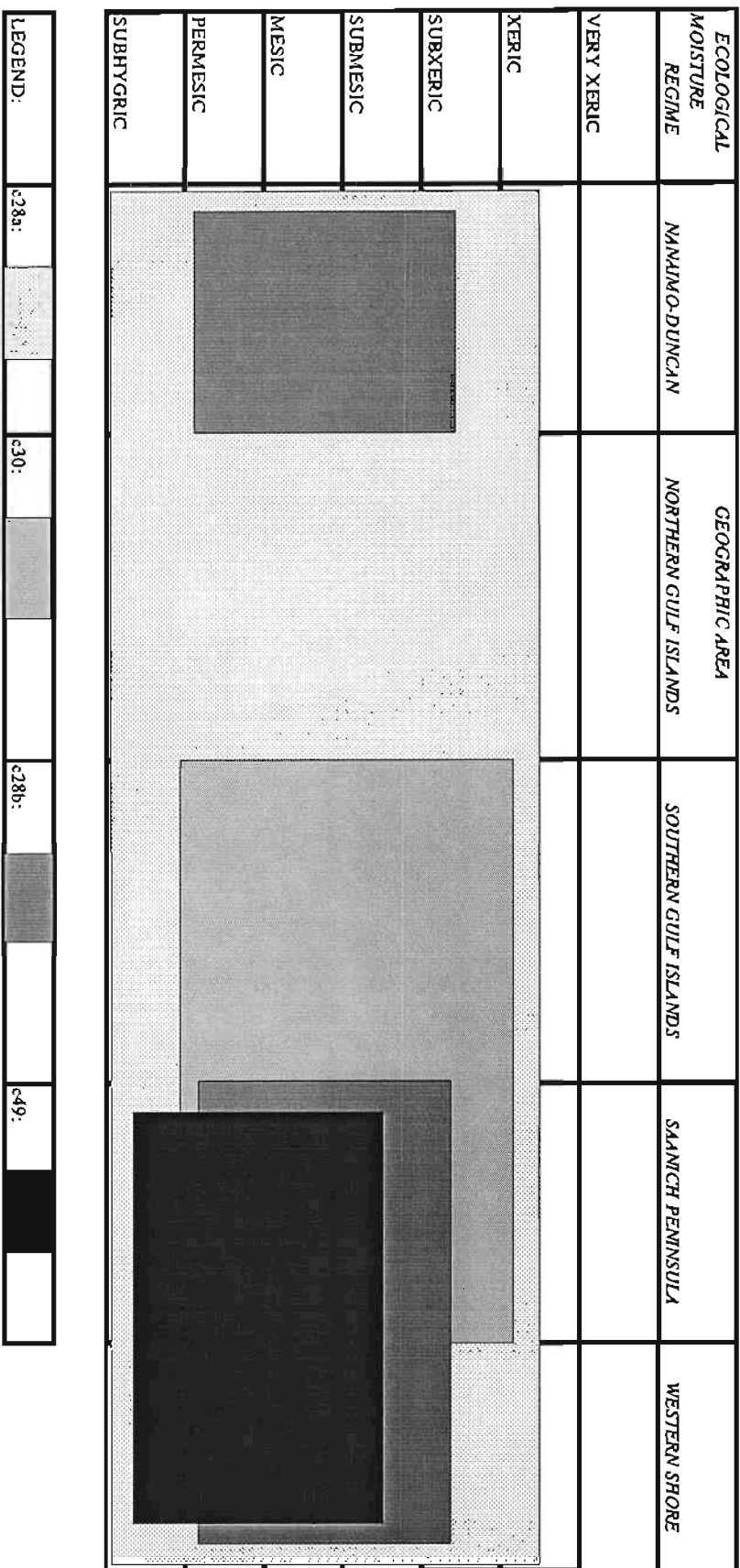
FIGURE 25. DISTRIBUTION AND MOISTURE REGIME OF FIRST ORDER DISTURBANCE PLANT COMMUNITIES (NON-BROOM) (1)

The-1-act7.248 (1960/29)



Plant communities are given by their alpha-numeric designation. See Figure 6 for their names and 5.11 for geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent island distinctions in occurrence.

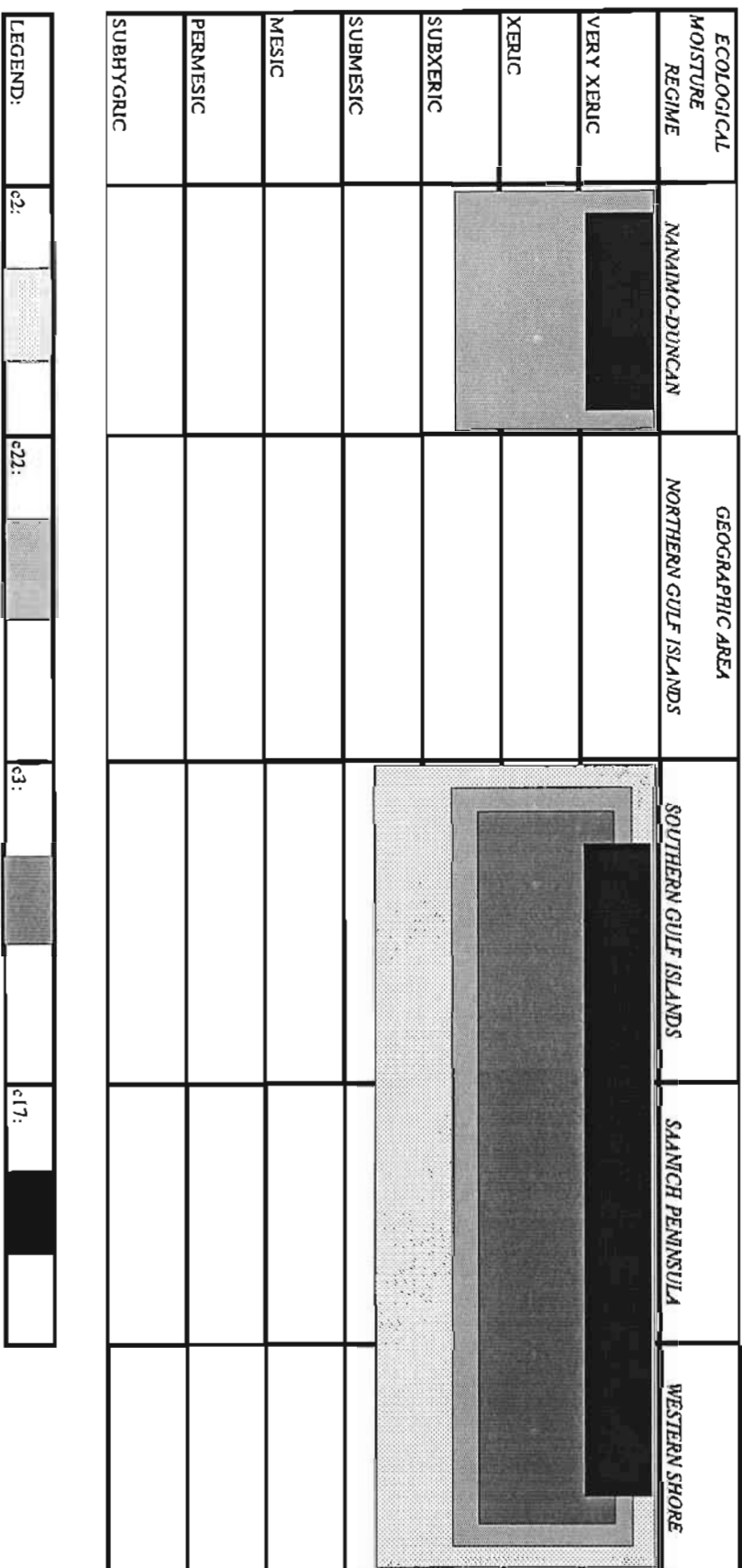
FIGURE 26. DISTRIBUTION AND MOISTURE REGIME OF FIRST ORDER DISTURBANCE PLANT COMMUNITIES (NON-BROOM) (2)



Plant communities are given by their alpha-numeric designation. See Figure 6 for names and 5.11 for geographic areas.

NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence. See Figure 6 for the names and 5.11 for geographic a

FIGURE 27. DISTRIBUTION AND MOISTURE REGIME OF SECOND ORDER DISTURBANCE PLANT COMMUNITIES (BROOM SERIES) (1)



Plant communities are given by their alpha-numeric designation. See Figure 7 for the names and 5.11 for geographic areas.
 NOTE that small offsets in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

FIGURE 28. DISTRIBUTION AND MOISTURE REGIME OF SECOND ORDER DISTURBANCE PLANT COMMUNITIES (BROOM SERIES) (2)

ECOLOGICAL MOISTURE REGIME	NANAIMO-DUNCAN		GEOGRAPHIC AREA		SOUTHERN GULF ISLANDS		SAANICH PENINSULA	WESTERN SHORE
VERY XERIC								
XERIC								
SUBXERIC								
SUBMESIC								
MESIC								
PERMESIC								
SUBHYGRIC								

LEGEND:	c5:				c4:					c6:					c3 b:		
---------	-----	--	--	--	-----	--	--	--	--	-----	--	--	--	--	-------	--	--

Plant communities are given by their alpha-numeric designation. See Figure 7 for the names and 5.11 for geographic areas.
 NOTE that small offacts in either axis are for the visibility of the plant communities and do not represent refined distinctions in occurrence.

6.1 PLANT COMMUNITIES

c50 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity

Ecosystem Description:

Frequency of Occurrence: 3 plots, infrequent

Distribution: From Plots: Galiano Island: Bodega Ridge, Galiano Mt.; Saanich Peninsula: Water Tower Hill From Notes: Nanaimo: Westwood Dr., Jack Pt.; Yellow Pt., Saanich Peninsula: Summit Pk., Beacon Hill Pk., Songhees- West Bay.

Plant Community Description: *Rhacomitrium canescens* (gray frayed-cap moss) occupies on all sites and averages class 4 to 5 cover. *Festuca bromoides* (introduced annual fescue) thrives on all sites and averages cover class 4.

Lotus micranthus (small-flowered lotus) grows on all sites and averages class 2 to 3 cover. *Lonicera hispidula* (hairy honeysuckle), *Elymus glaucus* (blue wildrye), *Aira praecox* (early hairgrass), and *Sanicula crassicaulis* (Pacific snakeroot) occupy on all sites and average class 2 cover. *Bromus carinatus* (California brome) and *Hypochaeris radicata* (introduced hairy cats ear) are present on all sites and average cover class 1.

The remaining species exist on most sites. *Carex inops* (long-stoloned sedge), *Bromus mollis* (introduced soft brome), *Cynosurus echinatus* (introduced dogtail bristlegrass), *Cerastium arvense* (field chickweed), *Trifolium microcephalum* (woolly clover), and *Polytrichum juniperinum* (juniper haircap moss) average cover class 2. *Luzula multiflora* (multi-flowered woodrush), *Bromus sterilis* (introduced barren barngrass), *Poa pratensis* (introduced Kentucky bluegrass), *Achillea millefolium* (yarrow), *Clarkia amoena* (farewell-to-spring), *Brodiaea coronaria* (harvest brodiaea), *Rumex acetosella* (introduced sheep sorrel), *Vicia hirsuta* (introduced hairy vetch), and *Vicia sativa* (introduced common vetch) average cover class 1.

Tree Canopy/ Landscape Expression: some of each of tree canopy (A), tall shrub (B1) canopy, and intermediate (A and B) canopies

Oak Characteristics: Diameters: generally small (13.8 to 33.9 cm);

Regeneration: Regeneration is occurring on most sites for both saplings and

seedlings. Both saplings and seedlings average moderately well-stocked.

Physiognomic Type: various, usually rockland or rock outcrop types.

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.89 Adjusted Motyka Comparison: 1.66 Oak - Broom - *Rhacomitrium canescens*: Typic subcommunity (c17); 0.87 Oak - *Rhacomitrium canescens* - *Selaginella wallacei* subcommunity (c46)

Elevation: high elevation, 110 to 300 m Slope: gentle to very steep (17 to 85 %)

Aspect: southwest, west Surface Shape: straight (2) and slightly convex (1)

Moisture Regime: xeric to very xeric Exposure: insolation, wind (2)

Bedrock Geology: coarse: granitic, conglomerate, sandstone

Surface Substrate Features: most plots (2) have high or very high (class 4 to 6) bedrock exposure Soil Classification: Orthic Sombric Brunisols (2), Orthic Regosols (1) Humus Classification: Rhizomulls (2), Vermimulls (1)

Depth of Ah Horizon: 4 to > 25 cm

Colour of Ah Horizon: dark, 10YR2/1, 2/1.5, or dark and brownish

Depth to Bedrock: shallow (4, 20 cm) to moderately deep (50 cm estimated)

Surface Soil Texture: silt loam (2) to sandy loam (1)

Percent Coarse Fragments: primarily low to medium (10 to 45 %)

Comments: This type was split from c3 based on lesser amounts of broom.

Discussion:

Soils shallow-to-bedrock, occurrence partly on very steep slopes, mostly at high elevations, and high or very high exposure of coarse bedrock partly distinguished this community. It is thought to be derived from c46 with disturbance, and to further degrade to c3.

Festuca bromoides (introduced annual fescue) was among the list of high constancy or dominance species not used for syntaxonomic purposes by Roemer (1972). A constant species in c50, *Aira praecox* was present along with Garry oak on exposed bedrock of the Shallow Soil landscape unit from Gabriola Island (Oswald,

1977). A Nootka rose-early hairgrass (*Aira praecox*) -rock outcrop vegetation unit with stunted Garry oak occurred near the ocean on Galiano, Thetis, Kuper, and Valdes Islands (Pattison and Karanka, 1981). *Aira praecox* was also characteristic of bare rock outcrops on Saturna and Mayne Islands (Janszen, 1977; 1981) and dominates the intermound sections on the Mima Mounds of western Washington Kruckeberg (1991). There is a discussion of *Rhacomitrium canescens*, *Achillea millefolium* and *Luzula multiflora* in c46.

Interpretations:

Preservation Priority: moderately high by general ranking.

Regeneration: Regeneration potential is moderately high. Seedling stocking is above average: moderately well-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Shrub oak- Rock Outcrop) to which this plant community has been assigned:

- indications of high utilization, high average numbers of wildlife use and wildlife habitat attributes, high numbers of bedrock and rock crevices and burrows.
- potential for attracting chaparral species
- increased food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- visual security and some thermal bedding, escape terrain, fresh sprouts, seeds, nectar, grasshoppers
- high total numbers of tree wildlife habitat features, high numbers of: perches, loose bark occurrences, scaling limbs, small and medium dead limbs.

Other stands have the following additional physiognomic type characteristics (Oak-Grass- Rockland):

- foraging space
- highest total tree features score

- high complexity of form in oak
- high number of perches
- high number of tree crevices/cavities
- some trees and stands with medium and large tree attributes: bark glean, foliage glean, perching, nesting, large dead limbs; other tree resources: snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Brodiaea coronaria is heavily preferred as fresh sprouts in spring by deer and other grazing animals. *Sanicula crassicaulis* (Pacific snakeroot) is also used. *Lonicera hispidula* (hairy honeysuckle) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and still provide the cavities and other resources for possible reintroductions. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling.

Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sarah orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). Composites such as *Achillea millefolium* (yarrow) provide nectar

for butterflies such as silvery blue (*Glaucopsyche lygadamus*), mylitta cresecent spot (*Phycoides mylitta*) and painted ladies (*Vanessa cardui*, *V.annabella*). *Lotus micranthus* (small-flowered lotus) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), which uses *Lotus*. *Trifolium microcephalum* (woolly clover) is probably a larval food plant for northern cloudywing (*Thorybes plyades*) and the endangered greenish blue (*Plebejus saepiolus insulanus*), both of which use *Trifolium*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high to high, based on the following:

- high and very high by physiognomic type
- low, with some moderate, by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Lonicera hispidula (hairy honeysuckle) has showy flowers which attract colourful hummingbirds and probably butterflies. *Carex inops* (long-stoloned sedge) and *Achillea millefolium* (yarrow), present in small to moderate amounts, enhance later season aesthetics by remaining green into the summer. The flowering and foliage of *Cerastium arvense* (field chickweed), *Trifolium microcephalum* (woolly clover), *Achillea millefolium* (yarrow), *Clarkia amoena* (farewell-to-spring) and *Brodiaea coronaria* (harvest brodiaea) provide interest and appeal, although present in small or moderate quantities. *Achillea millefolium* (yarrow) has cultural heritage value for its historic aboriginal medicinal use. This plant community is often on hilltops which are the destination of hikers, birders and naturalists. Awns and calluses of weedy grasses reduce recreation enjoyment by lodging in hiker's socks and bothering them.

Susceptibility to Disturbance: moderately high

Prescribed Fire: The potential and need for the use of prescribed fire is low, and often inadvisable.

Threats: high

Restoration Potential: moderate

Restoration Priority: low

Special Management: *Lotus micranthus* (small-flowered lotus) and *Trifolium microcephalum* (woolly clover), present in moderate to substantial quantities, are important for their ability to fix atmospheric nitrogen. Consideration should also be given to these species for their yellow (potentially vulnerable) status, along with *Brodiaea coronaria* (harvest brodiaea) and *Clarkia amoena* (farewell-to-spring) (both varieties) which are present in small amounts. *Brodiaea coronaria* (harvest brodiaea) is cultivated and used in native plant gardening.

c21 Oak - *Cynosurus echinatus* (late season)

Ecosystem Description:

Frequency of Occurrence: 9 plots, frequent

Distribution: From Plots: Duncan- Nanaimo: Nanoose Bay, Yellow Point; southern Gulf Islands: Saltspring Island, Galiano Island: Salalidikim Rock; Saanich Peninsula: Scafe Hill From Notes: Nanaimo: Piper's Lagoon; Newcastle Is., Lone Tree Hill.

Plant Community Description: *Cynosurus echinatus* (introduced dogtail bristlegrass) occupies all sites and has high cover, an average of class 5. The remaining species occur on most sites. *Poa pratensis* (introduced Kentucky bluegrass), *Trifolium microcephalum* (woolly clover), and *Rhacomitrium canescens* (gray frayed-cap moss) average class 2 to 3 cover. *Elymus glaucus* (blue wildrye), *Bromus sterilis* (introduced barren barngrass), and *Lotus micranthus* (small-flowered lotus) average cover class 2. *Cerastium arvense* (field chickweed) averages cover class 1 to 2.

Tree Canopy/ Landscape Expression: tree canopy (A) layer, mostly high cover (class 5 or 6) (6)

Oak Characteristics: Diameters: mainly large diameter (6);

Regeneration: Regeneration is present on most sites for saplings and on some sites for seedlings. Both average light stocking.

Physiognomic Type: usually Oak - Grass - Parkland (8).

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.48 Adjusted Motyka Comparison: 0.51 Oak- Broom - *Cynosurus echinatus* (late season) (c2); 0.38 Oak- *Mahonia aquifolium* (c26); 0.15 Oak- *Bromus sterilis* (c23); 0.09 Oak- *Elymus glaucus* (c47); 0.08 Oak- *Lonicera hispidula* (c16a).

Elevation: various, but 5 plots are from higher elevation Slope: gentle to steep Aspect: chiefly south to southwest (west) Surface Shape: straight (4) to concave (4) Moisture Regime: generally xeric to very xeric Exposure: insolation, wind, some seaspray (2) Bedrock Geology: normally coarse: granitic, conglomerate, gneiss Surface Substrate Features: some moderate to high bedrock exposure (class 3 or 4) (4) Soil Classification: ordinarily Orthic Humic Regosols and Orthic Sombric Brunisols (4) Humus Classification: usually Rhizomulls (6)

Depth of Ah Horizon: 8 to 30 cm, or > 20 to 35 cm (3)

Colour of Ah Horizon: chiefly dark 10YR2/1 (7)

Depth to Bedrock: mostly 8 to 30 cm Surface Soil Texture: sandy loam to silt loam, gravelly to very gravelly Percent Coarse Fragments: many (5) have high coarse fragments (55 to 80 %) in surface soils

Comments: usually xeric, disturbed sites. Comparable with c2 from the Saanich Peninsula and Galiano Island, where broom has invaded more widely.

Discussion:

This community is partly distinguished by soils shallow to bedrock, high surface coarse fragments, and occurrence partly on steep slopes, mostly at high elevations. It is thought to be derived from c27, c25, and c26 with disturbance, and to further degrade to c2.

Cynosurus echinatus was used to name three grassland and three oak plant associations from the Umpqua River area of southern Oregon (Smith, 1985). One community is related to the grassland sites grazed for a full season in the Bald Hills oak woodlands described by Saenz and Sawyer (1986). *Cynosurus echinatus* is an introduced dominant species, often used to name communities, in several other areas

(Keeler-Wolf, 1990; Riegel et al., 1992; Roemer, 1972; Sugihara et al., 1987). A *Quercus garryana*/*Cynosurus* community was described from xeric stands on the Bald Hills oak woodlands of Redwood National Park by Sugihara et al.(1987). The communities also correspond to my plots from the same area, further south on the Alderpoint Rd. and near the Umpqua River, Oregon. The *Arrhenatherum*/*Sherardia* described by Sugihara et al.(1987) for the Bald Hills oak woodlands is another possible analogue. A grassland on the Soldier Research Natural Area, California described by Keeler-Wolf (1990) included *Cynosurus echinatus* as a dominant along with various annual and perennial species. *Cynosurus echinatus* was among five species from the *Quercus-Geranium* (QG) Typic subassociation of Roemer (1972). Aldrich (1972) identified a *Cynosurus echinatus* unit as being seral to *Elymus glaucus* in the non-oak Oregon "balds". There is a discussion of *Bromus sterilis* in c23.

Interpretations:

Preservation Priority: low by general ranking.

Regeneration: Regeneration potential is very low. Seedlings are only present on some sites. Saplings are only lightly-stocked. Otherwise normal.

Wildlife Habitat and Use: Most stands have the physiognomic type Oak- Grass-Rockland, with the following characteristics:

- indications of high utilization, high average numbers of wildlife and wildlife attributes, high numbers of bedrock and rock crevices, thermal south slopes and some bedrock exposure; bedding and foraging, visual security bedding, escape terrain
- seeds, foraging space, grasshoppers, fresh sprouts, nectar
- highest numbers of total tree features, high complexity of form and large diameters in oak giving habitat opportunities, high numbers of small and large dead limbs, high numbers of perches, high numbers of tree crevices/cavities
- other large tree attributes: bark glean, foliage glean, nesting, snags, logs and decaying logs, loose bark, hollow logs or tree hollows

The rockiness and exposure of this community provides habitat for garter snakes. The rockiness of some sites provides potential hibernacula. The large diameter oaks of this plant community provide tree hollows which are a focal habitat feature for raccoons (*Procyon lotor*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. *Lotus micranthus* (small-flowered lotus) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), which uses *Lotus*. *Trifolium microcephalum* (woolly clover) is probably a larval food plant for northern cloudywing (*Thorybes plyades*) and the endangered greenish blue (*Plebejus saepiolus insulanus*), both of which use *Trifolium*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high to high, based on the following:

- high by physiognomic type
- high by oak diameter (size class)
- moderately high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

The flowering and foliage of *Cerastium arvense* (field chickweed) and *Trifolium microcephalum* (woolly clover) provide interest and appeal, although present in small or moderate quantities. This plant community is often on hilltops which are the destination of hikers, birders and naturalists. Awns and calluses of weedy grasses reduce recreation enjoyment by lodging in hiker's socks and bothering them.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is low, and often inadvisable.

Threats: moderately high

Restoration Potential: low

Restoration Priority: low

Special Management: Tree protection devices or other measures may be required against deer browsing if adequate regeneration is to be achieved. *Lotus micranthus* (small-flowered lotus) and *Trifolium microcephalum* (woolly clover), present in moderate to substantial quantities, are important for their ability to fix atmospheric nitrogen. Consideration should also be given to these species for their yellow (potentially vulnerable) status.

c23 Oak - *Bromus sterilis*

Ecosystem Description:

Frequency of Occurrence: 9 plots, frequent

Distribution: From Plots: Yellow Point: Deer Pt; Pender Island: Oak Bluffs, Hermit Hill; Saanich Peninsula: Observatory Hill, Mt. Doug., Uplands, Beacon Hill Park

From Notes: Mayne Is.: Heck Hill.

Plant Community Description: *Bromus sterilis* (introduced barren barngrass) thrives on all sites, with an average class 4 cover. *Vicia sativa* (introduced common vetch) occupies all sites and averages class 2 to 3 cover. The remaining species are present on most sites. *Elymus glaucus* (blue wildrye), *Bromus carinatus* (California brome grass), *Festuca bromoides* (introduced annual fescue), *Vicia hirsuta* (introduced hairy vetch), *Sanicula crassicaulis* (Pacific snakeroot), and *Galium aparine* (cleavers) average cover class 2.

Tree Canopy/ Landscape Expression: mostly tree canopy (A) layer (6), some tall shrub (B1) layer (3)

Oak Characteristics: Diameters: various; Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Stocking averages moderately well for

both.

Physiognomic Type: various: some Oak - Grass - Parkland (3).

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.45 Adjusted Motyka Comparison: 1.0 Oak- *Poa pratensis* (c29a); 0.75 Oak- *Lonicera hispidula* (c16a); 0.57 Oak- *Dactylis glomerata*: Typic subcommunity (c28a); 0.55 Oak- *Mahonia aquifolium* (c26); 0.44 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum* subcommunity (c22); 0.36 Oak- *Elymus glaucus* (c47); 0.19 Oak- *Anthoxanthum odoratum* (c31a); 0.15 Oak - *Cynosurus echinatus* (late season) (c21).

Elevation: low to high elevation Slope: gentle to very steep Aspect: usually southwest to west (6) Surface Shape: ordinarily straight (5), some convex (2)

Moisture Regime: usually subxeric to xeric Exposure: insolation, wind

Bedrock Geology: coarse: granitic, gneiss, conglomerate, sandstone

Surface Substrate Features: some (4) have either moderately high bedrock exposure (class 3) (2) or moderate to high (class 3 to 5) surface coarse fragments (4)

Soil Classification: Orthic Sombric Brunisols Humus Classification: Rhizomulls (5), or Vermimulls (3) Depth of Ah Horizon: usually > 10 cm to 30 cm (7)

Colour of Ah Horizon: dark, 10YR2/1, 2/1.5 Depth to Bedrock: usually none, some 8 to 20 cm (2) Surface Soil Texture: sandy loam to silt loam, gravelly to very gravelly

Percent Coarse Fragments: some plots (5) have high subsurface coarse fragments

Comments: There are both broom (2) and non-broom plots included. With more sampling, these might be separated. This type, c23, is thought to be derived from the *Festuca idahoensis* series (c20, 25, 27, 42).

Discussion:

Occurrence on very steep slopes and the presence of deep, dark *Ah* horizons partly distinguishes this community. It is generally more xeric than c28a and is thought to be derived from c16a, c26, c47, and c43 through disturbance.

An Oak-Brome (*sterilis*) association was recognized for this introduced species

in the B.C. Ministry of Forests Ecology Program's re-sorting of Roemer's (1972) data. *Bromus sterilis* was among five species from the *Quercus-Geranium* (QG) Typic subassociation of Roemer (1972). *Bromus sterilis* was part of a community described by Janszen (1977; 1981) for Saturna and Mayne Islands. *Bromus sterilis* was a principal species of the non-oak *Festuca idahoensis* grassland on Sucia Island, Washington (Fonda and Bernardi, 1976). There is a discussion of *Vicia hirsuta* in c29a.

Interpretations:

Preservation Priority: low by general ranking.

Regeneration: Regeneration potential is moderately high. Seedling stocking is above average: moderately well-stocked. Otherwise normal.

Wildlife Habitat and Use: Most stands have the physiognomic type Oak- Grass-Rockland, with the following characteristics:

- indications of high utilization, high average numbers of wildlife and wildlife attributes, high numbers of bedrock and rock crevices, thermal south slopes and some bedrock or rock exposure: bedding and foraging, visual security bedding, escape terrain
- seeds, foraging space, grasshoppers, fresh sprouts, nectar
- highest numbers of total tree features, high complexity of form in oak giving habitat opportunities, high numbers of small dead limbs, high numbers of perches, high numbers of tree crevices/cavities
- some trees and stands have large tree attributes: large diameters giving habitat opportunities, high numbers of large dead limbs, bark glean, foliage glean, nesting, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Sanicula crassicaulis (Pacific snakeroot) is used as fresh sprouts by Coast deer and other grazing animals. The rockiness and exposure of this community provides habitat for garter snakes. The rockiness of some sites provides potential hibernacula. Trees

or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. *Bromus carinatus* (California bromegrass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high to high, based on the following:

- high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Vicia sativa (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) provide some aesthetic value with their flowering. Awns and calluses of weedy grasses reduce recreation enjoyment by lodging in hiker's socks and bothering them.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: moderately high to high

Restoration Potential: low

Restoration Priority: moderate

c31a Oak - *Anthoxanthum odoratum*

Ecosystem Description:

Frequency of Occurrence: 7 plots, moderately frequent in certain areas

Distribution: From Plots: Hornby Island, Nanaimo: Harewood Plains; Saltspring Island; Saanich Peninsula: Gore Pk., Water Tower Hill, Beacon Hill Pk.

From Notes: Tumbo Is., Pender Is.: Oak Bluffs; Portland Is., West Chatham Is., Florence Lake, Fort Rodd Hill, Mary Hill.

Plant Community Description: *Anthoxanthum odoratum* (introduced sweet vernalgrass) thrives on all sites, and averages class 4 to 5 in cover. *Poa pratensis* (introduced Kentucky bluegrass) averages class 3 and occupies all sites. The remaining species are present on most sites. *Symphoricarpos albus* (snowberry), *Elymus glaucus* (blue wildrye), *Danthonia californica* (California oatgrass), *Dactylis glomerata* (introduced orchardgrass), *Vicia sativa* (introduced common vetch), and *Trifolium dubium* (introduced small hop clover) average cover class 2. *Sanicula crassicaulis* (Pacific snakeroot), *Galium aparine* (cleavers), and *Plantago lanceolata* (introduced narrow leaved plantain) average class 1 to 2. *Ranunculus occidentalis* (western buttercup) averages class 1.

Tree Canopy/ Landscape Expression: usually tree layer (A) canopy (5)

Oak Characteristics: Diameters: various, 15.9 cm to 57.8 cm;

Regeneration: There is regeneration on most sites for saplings and some sites for seedlings. Sapling stocking averages moderately well-stocked. Seedlings are lightly-stocked.

Physiognomic Type: usually Oak - Grass Parkland (4) or Shrub Oak Basin (2).

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.49 Adjusted Motyka Comparison: 0.74 Oak - Broom - *Anthoxanthum odoratum* (c31b); 0.55 Oak - *Poa pratensis* (c29a); 0.48 Oak - *Dactylis glomerata*: Typic; 0.36 Oak - *Melica subulata* (c13); 0.19 Oak - *Bromus sterilis* (c23)

Elevation: low to high Slope: gentle to moderate slopes

Aspect: southeast, south to west Surface Shape: normally concave (5)

Moisture Regime: generally compensating submesic to mesic (5), some subxeric to xeric (2) Exposure: some wind (3) and insolation (2)

Bedrock Geology: coarse: granitic, conglomerate, sandstone

Surface Substrate Features: most plots (5) have either moderately high (class 3) bedrock exposure (2) or moderate to high (class 3 or 4) surface rocks (3)

Soil Classification: Orthic Sombric Brunisols (5), Regosols (2)

Humus Classification: generally Rhizomulls

Depth of Ah Horizon: primarily > 10 to 30 cm (4), or 8 to 10 cm (3)

Colour of Ah Horizon: mainly dark, 10YR2/1 (5), or dark and slightly brownish

Depth to Bedrock: 8 to 60 cm (estimated) (5), or without (2)

Surface Soil Texture: chiefly silt loam (5), some gravelly to very-gravelly subsurface coarse fragments Percent Coarse Fragments: various

Comments: Slightly moister sites in a bedrock landscape because of concave to slightly concave surface shape. This type might be derived from, and partly include, an unclassified native type, Oak - *Danthonia californica* basin, which was recognized in the surveying. However, this unclassified type often did not occupy the minimum size required for plot representation.

Discussion:

This community is distinguished by its occurrence on moister sites in a bedrock landscape, the presence of deep, dark *Ah* horizons in soils with a shallow to moderate depth to bedrock. It is thought to be derived from c47, c43, c13, and an unclassified Oak - *Danthonia californica* basin type through disturbance. With further disturbance c31a will degrade to c31b.

No communities are described in the literature for *Anthoxanthum odoratum* (introduced sweet vernal grass). *Danthonia californica*, constant in c31a, was part of the dominant species-combination in the *Quercus-Erythronium-Montia-Fragaria* variant of Roemer (1972). The other important species of c31a were not included. *Danthonia californica* was part of a community described by Janszen (1977; 1981) for Saturna and Mayne Islands. None of the other species from this community were important in c31a. A Garry Oak - hairy honey suckle - California fescue (oatgrass ?) vegetation unit was named on Galiano and smaller islands by Pattison and Karanka (1981),

apparently for *Danthonia californica*. *Danthonia californica* was among the species from in the *Rhus-Gramineae* variant of Thilenius (1964). *Danthonia californica* was present in the *Viola adunca* provisional association from the non-oak Oregon "balds" (Aldrich, 1972), was typical of the grasslands of the Willamette Valley (Franklin and Dyrness, 1973), and was used to name the *Festuca - Danthonia* grassland on the coastal prairie of northern California (Heady et al., 1977). There is a discussion of *Poa pratensis* in c29a, *Dactylis glomerata* in c28a and *Elymus glaucus* in c47.

Interpretations:

Preservation Priority: low by general ranking, but elevated to moderately high to allow the possibility of restoring the Oak - *Danthonia californica* basin type.

Regeneration: Regeneration potential is moderately low. Seedlings are only present on some sites. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Other stands have the following additional physiognomic type characteristics (Shrub Oak - Basin):

- potential for attracting chaparral bird species, increased food for foliage gleaners due to relatively more insect outbreaks, dense, low cover for hiding

and security in shrub oak, fresh sprouts, nectar.

Rich soil resources, such as earthworms, are taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. There are thermal bedding and foraging opportunities on moderate south and west slopes, bedrock and rock exposure. The rockiness and exposure of this community provides habitat for garter snakes, especially in the moister settings of basins and other receiving positions. The rockiness of some sites provides potential hibernacula. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th. *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies.

Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris*

diffinis). *Plantago lanceolata* (introduced narrow leaved plantain) substitutes for native *Plantago* spp. in hosting the larvae of the endangered Edith's checkerspot butterfly (*Euphydryas editha taylori*) in one of its last remaining populations. There are a number of skippers which feed on grasses not specifically known. These will probably include native species such as *Danthonia californica*, as suggested by studies of related species outside the British Columbia range. For example, *Danthonia californica* is used by larvae of *Hesperia lindseyi*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high to high, based on the following:

- moderate to high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- low to moderately high by oak form-complexity within physiognomic type

Symphoricarpos albus (snowberry), present in moderate amounts, adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Ranunculus occidentalis* (western buttercup), present in small amounts, gives some appeal with its early season flowering. *Vicia sativa* (introduced common vetch) is present in moderate amounts and provides some aesthetic value with its flowering. This community often occurs on sites with a view.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: moderately high to high

Restoration Potential: moderate

Restoration Priority: very high, to allow possible restoration of *Danthonia californica* type

Special Management: Tree protection devices or other measures may be required against deer browsing if adequate regeneration is to be achieved. *Danthonia californica* (California oatgrass), present in moderate quantities, is central to recovery in this community. California oatgrass should be selected for propagation and use in

restoration. *Elymus glaucus* (blue wildrye), present in moderate quantities, is also important in recovery. Blue wildrye has been cultivated, but seed from the Garry oak habitat should be selected for any restoration. Burning plans should consider a conflict with the endangered Edith's checkerspot (*Euphydryas editha taylori*), whose larvae is hosted by *Plantago lanceolata* (introduced narrow leaved plantain), substituting for native *Plantago* spp. in one of its last remaining populations. Consideration should be given to *Triteleia hyacinthina*, a plant species with yellow (potentially vulnerable) status, for which this community seems to provide habitat.

c29a Oak - *Poa pratensis* - *Vicia sativa*

Ecosystem Description:

Frequency of Occurrence: 14 plots, frequent

Distribution: From Plots: widespread: Duncan-Nanaimo: Jack Pt., Yellow Pt.; southern Gulf Islands: Cabbage Is., Saturna Is., Pender Is.- Hermit Hill, Oak Bluffs, Saltspring Is.; Saanich Peninsula: Water Tower Hill, Uplands Pk., Skirt Mt.; western shore: Juan de Fuca Pk., Pedder Bay From Notes: Yellow Pt.: Deer Pt.; Maple Bay, Saanich Peninsula: Woodsend Drive

Plant Community Description: *Poa pratensis* (introduced Kentucky bluegrass) occupies all sites and averages cover class 3 or 4. The remaining species exist on most sites. *Vicia sativa* (introduced common vetch) is cover class 3. *Geranium molle* (introduced dovefoot geranium) and *Vicia hirsuta* (introduced hairy vetch) average class 2 or 3. *Elymus glaucus* (blue wildrye), *Bromus sterilis* (introduced barren barngrass), *Sanicula crassicaulis* (Pacific snakeroot) and *Galium aparine* (cleavers) are class 2. *Bromus carinatus* (California brome grass) averages class 1 to 2. *Festuca bromoides* (introduced annual fescue) and *Hypochaeris radicata* (introduced hairy cats ear) are class 1.

Tree Canopy/ Landscape Expression: mostly high cover (class 5,6) tree canopy (A) layer (9), some tall shrub (B1) layer canopy (4)

Oak Characteristics: Diameters: various; Regeneration: Stocking averages light to

moderate for both seedlings and saplings. Regeneration is present on most sites. Physiognomic Type: usually Oak - Grass - Parkland (5), Oak - Light Shrub - Herb - Bulb Parkland (5), some Oak - Moderate Shrub - Herb - Bulb Parkland (2), and others.

Suggested Successional Status: Mature Disclimax from both Mature Edaphic Climax and Mature Climatic Climax

Constant Cover Value: 0.46 Adjusted Motyka Comparison: 1.0 Oak - *Bromus sterilis* (c23); 0.73 Oak - *Dactylis glomerata*: Typic (c28a); 0.66 Oak - *Melica subulata* (c13); 0.64 Oak - Broom - *Poa pratensis* (c4); 0.55 Oak - *Anthoxanthum odoratum* (c31a); 0.29 Oak - *Carex inops* (c14).

Elevation: various Slope: generally gentle (9)

Aspect: normally east, south, west (10) Surface Shape: straight (6), concave (5), and various Moisture Regime: ordinarily submesic (12) to mesic (4)

Exposure: insolation (12), wind (10), seaspray (5) Bedrock Geology: coarse: sandstone, granitic (9) Surface Substrate Features: some moderately high or high (class 3 and 4) bedrock exposure (3) Soil Classification: Orthic Sombric Brunisols (10), Regosols (3) Humus Classification: Vermimulls (11), Orthic Rhizomulls (3)

Depth of Ah Horizon: > 30 cm (7), or 5 to 30 cm (7)

Colour of Ah Horizon: dark, 10YR 2/1, 2/1.5 (11), or dark and slightly brownish (3)

Depth to Bedrock: usually without (10), or 7 to 80 cm (estimated) (6)

Surface Soil Texture: sandy loam to silt loam, commonly gravelly to very-gravelly (10)

Percent Coarse Fragments: various, sometimes (5) high coarse fragments in the surface soil

Discussion:

Occurrence on sites lacking bedrock and on concave slope positions which receive additional soil moisture from the surrounding landscape partly distinguish this community. It has coarser textured soil (sandy loam to silt loam) than c28a (silt loam) and is thought to be derived through disturbance from c13, c14, c47, and c43. Continued disturbance leads to its degradation into c4.

Communities are not described in the literature for these species. *Poa pratensis* and *Vicia sativa* were among five other species Roemer (1972) recognized for the *Quercus-Bromus Alliance*. *Poa pratensis* occurs in both the *Quercus-Geranium* association of Roemer (1972) and the *Elymus glaucus* provisional association of Aldrich (1972) from the non-oak Oregon "balds". *Poa pratensis* was among the species featured in the *Rhus-Gramineae* variant of Thilenius (1964). There is a discussion of *Bromus carinatus* in c43 and *Elymus glaucus* in c47.

Interpretations:

Preservation Priority: low by general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is moderately low. Seedling stocking is above average: lightly- to moderately-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Other stands have the following physiognomic type characteristics (Oak- Light Shrub Cover- Herb - Bulb Parkland):

- thermal bedding and foraging on moderate south to west slopes and some bedrock exposure
- foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features

- some trees with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches, bark glean, foliage glean, nesting opportunities, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows.

Sanicula crassicaulis is used as fresh sprouts in spring by deer and other grazing animals. Earthworms and other rich soil attributes are provided by this community and are taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high to high, based on the following:

- high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Vicia sativa (introduced common vetch), *Geranium molle* (introduced dovefoot geranium) and *Vicia hirsuta* (introduced hairy vetch) are present in moderate to substantial amounts, providing some aesthetic value with their late flowering and interest value with the pods of the vetches.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: high to very high

Restoration Potential: low

Restoration Priority: moderately high

Special Management:

Elymus glaucus (blue wildrye) and *Bromus carinatus* (California brome), present in small to moderate quantities, are important to the recovery of this community. These species have been cultivated, but seed from Garry oak habitat selections should be used in any restoration. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) are present in moderate to substantial amounts, and have the ability to fix atmospheric nitrogen. This ability could be put to use on certain sites where maintenance, not recovery, is the objective, or as a transitional measure for rehabilitative restoration.

c28a Oak - *Dactylis glomerata* Typic subcommunity

Ecosystem Description:

Frequency of Occurrence: frequent, 16 plots

Distribution: From Plots: widespread: Duncan - Nanaimo: Hornby Is., Piper's Lagoon, Newcastle Is., Yellow Pt., Genoa Bay; Pender Is.: Stanford Hill; Saltspring Is.: Channel Ridge; Saanich Peninsula: Mt. Finlayson, Water Tower Hill, UVIC, Uplands, Gonzales Hill; western shore: Fort Rodd Hill, Witty's Lagoon, Mary Hill.

From Notes: Nanoose Hill, Somenos Lk., Gabriola Is.; Galiano Is.: Bellhouse Pk., Portland Is., Saanich Peninsula: Glendenning Dr., Frances King Pk.; western shore: Lester Pearson College, Rocky Pt.

Plant Community Description: *Dactylis glomerata* (introduced orchardgrass) averages cover class 4 and thrives on all sites. The remaining species are present on most sites. *Symphoricarpos albus* (snowberry) averages class 2 or 3. *Elymus glaucus* (blue wildrye) and *Bromus carinatus* (California bromegrass) average class 2. *Vicia hirsuta* (introduced hairy vetch), *Vicia sativa* (introduced common vetch), *Sanicula crassicaulis* (Pacific snakeroot), *Galium aparine* (cleavers) and *Geranium molle* (introduced dovefoot geranium) average class 2.

Tree Canopy/ Landscape Expression: tree canopy (A) layer, often with high cover, class 5 or 6 (9)

Oak Characteristics: Diameters: various; Regeneration: Regeneration is present on most sites for both saplings and seedlings. Stocking averages light to moderate for both. Physiognomic Type: various: often Oak - Grass - Parkland (6), some Oak - Light Shrub - Herb - Bulb Parkland (2), and others.

Suggested Successional Status: Mature Disclimax from Mature Climatic Climax

Constant Cover Value: 0.45 Adjusted Motyka Comparison: 1.85 Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity (c28b); 1.07 Broom - *Dactylis glomerata* (c5); 0.87 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity (c49); 0.79 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity (c30); 0.73 Oak - *Poa pratensis* (c29a); 0.59 Oak - *Lathyrus nevadensis* (c41); 0.57 Oak - *Bromus sterilis* (c23); 0.48 Oak - *Anthoxanthum odoratum* (c31a); 0.39 Oak - *Bromus carinatus* (c43); 0.30 Oak - *Elymus glaucus* (c47).

Elevation: various elevations Slope: mostly gentle to moderate slopes

Aspect: east (south) to west Surface Shape: straight (7), concave (4), and various

Moisture Regime: usually submesic to mesic (xeric to subhygric)

Exposure: wind (12), insolation (10), some seaspray (3)

Bedrock Geology: chiefly coarse: granitic, gneiss, conglomerate, sandstone

Surface Substrate Features: some (5) moderate to very high (class 3 to 6) bedrock exposure or moderate to high surface rocks (class 3,4) (3)

Soil Classification: usually Orthic Sombric Brunisol (12)

Humus Classification: Rhizomulls and Vermimulls

Depth of Ah Horizon: usually >25 or 30 cm Colour of Ah Horizon: usually dark, 10YR 2/1 Depth to Bedrock: usually none, or 5-25 cm (4)

Surface Soil Texture: usually silt loam (12)

Percent Coarse Fragments: various, some with high subsurface horizon coarse fragments (6)

Comments: Together with Oak - Broom - *Dactylis glomerata* (c5), this community is the most dominant and widespread in the Garry oak habitat. Replacement by broom types, such as this latter community, seems to account for the reduced frequency on Galiano, Gabriola and most of Saltspring Island. One plot from Saltspring Island (93 SS18) could be added. *Dactylis glomerata* (orchardgrass) is used in seeding, consequently this type is partly found on old pastures. The presence of *Symphoricarpos albus* could potentially divide c28a, but it was not frequent enough, being represented by only three plots.

Discussion:

This subcommunity occurs mostly on sites without bedrock in the soil profile and partly in concave slope positions which receive additional soil moisture from the surrounding landscape. Deep, dark *Ah* horizons with silt loam texture are a further characteristic which partly distinguish this community. It may have been more disturbed than c28b, or has not recovered in the same way. It is generally less xeric than c23 and has finer textured soil (silt loam) than c29a (sandy loam to silt loam).

This subcommunity is thought to be derived most directly from c28b, and from c47, c41, and c43. Two communities, c30 and c49, are in turn derived from c28a. Degradation will lead to development into c5.

Oak communities named for *Dactylis glomerata* are widespread, being noted for Galiano and smaller islands (Pattison and Karanka, 1981); Willamette Valley, Oregon (Thilenius, 1964, 1968); the southern interior valleys of Oregon (Riegel et al., 1992; Smith, 1985); and the Bald Hills oak woodlands of northern California

(Sugihara et al., 1987). A *Quercus/Dactylis* community was described from mesic stands on the Bald Hills oak woodlands of Redwood National Park by Sugihara et al. (1987). *Dactylis glomerata* was among the species featured in the *Rhus-Gramineae* variant of Thilenius (1964) from the Willamette Valley. Salstrom (1989) included a few plots with moderate or substantial *Dactylis glomerata* cover in the *Pseudotsuga menziesii* - *Quercus garyana* - *Lonicera hispidula* community on Pt. Disney, Waldron Island, Washington. There is a discussion of *Elymus glaucus* in c47.

Interpretations:

Preservation Priority: low by general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is moderately low. Seedling stocking is above average: lightly- to moderately-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Other stands have the following additional physiognomic type characteristics (Oak-Light Shrub Cover- Herb - Bulb Parkland):

- thermal bedding and foraging on moderate south to west slopes and on some bedrock and rock exposure
- foraging space, nectar, abundant numbers of bird species

- high numbers of tree habitat features
- some trees or stands with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches

Sanicula crassicaulis is used as fresh sprouts in spring by deer and other grazing animals. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but appears to be higher as I recorded several spring utilization records. Earthworms and other rich soil attributes are provided by this community and are taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent. *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high to high, based on the following:

- high by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Symphoricarpos albus (snowberry), present in moderate to substantial amounts, adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Galium aparine* (cleavers) has cultural heritage value for its historic use in aboriginal technology. *Vicia sativa* (introduced common vetch), *Vicia hirsuta* (introduced hairy vetch) and *Geranium molle* (introduced dovefoot geranium) are present in moderate to substantial amounts, providing some aesthetic value with their flowering and interest value with the pods of the vetch. This community sometimes forms a part of a pastoral type landscape.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: very high

Restoration Potential: low

Restoration Priority: moderately high

Special Management:

Consideration should be given to *Triteleia hyacinthina*, a plant species with yellow (potentially vulnerable) status, which this community seems to provide habitat for. *Elymus glaucus* (blue wildrye) and *Bromus carinatus* (California brome grass), present in moderate quantities, are important to the recovery of this community. These species have been cultivated, but seed from Garry oak habitat selections should be used in any restoration. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) are present in moderate to substantial amounts, and have the ability to fix atmospheric nitrogen. This ability could be put to use on certain sites where maintenance, not recovery, is the objective, or as a transitional measure for rehabilitative restoration.

c28b Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity

Ecosystem Description:

Frequency of Occurrence: 5 plots

Distribution: From Plots: Saanich Peninsula: Water Tower Hill, Glendale Lands, Naden Hill, southern Gulf Islands - Pender, Tumbo Is. From Notes: Nanaimo: Jack Pt.

Plant Community Description: *Dactylis glomerata* (introduced orchardgrass) occupies all sites and averages cover class 4 to 5. *Bromus carinatus* (California brome) grows on all sites and averages class 3 cover. *Poa pratensis* (introduced Kentucky bluegrass) occurs on all sites and averages class 3 or 4. *Vicia hirsuta* (introduced hairy vetch) is present on all sites and averages class 2 for cover. The remaining species exist on most sites and average class 2 cover: *Elymus glaucus* (blue wildrye), *Vicia sativa* (introduced common vetch), *Galium aparine* (cleavers), and *Camassia leichtlinii* (great camas). *Hypochaeris radiata* (introduced hairy cats-ear) and *Sanicula crassicaulis* (Pacific snakeroot) are present on most sites and average class 1 or 2.

Tree Canopy/ Landscape Expression: tree canopy (A) layer, mostly with high cover (class 5 or 6) (4)

Oak Characteristics: Diameters: small to (mainly) large (3);

Regeneration: Regeneration is present on most sites for both saplings and seedlings. Stocking averages light for seedlings and moderate for saplings.

Physiognomic Type: usually Oak - Grass Parkland

Suggested Successional Status: Mature Disclimax, probably from Mature Edaphic Climax

Constant Cover Value: 0.64 Adjusted Motyka Comparison: 1.85 Oak - *Dactylis glomerata*: Typic subcommunity (c28a); 0.48 Oak - *Bromus carinatus* (c43).

Elevation: primarily low elevation, one high elevation plot

Slope: gentle (4), moderate (1) Aspect: east (south) to west

Surface Shape: straight (3) (and various) Moisture Regime: about submesic (subxeric to permesic) Exposure: insolation (3), wind (2), seaspray (2)

Bedrock Geology: various Surface Substrate Features: some moderately or high bedrock (class 3 to 5) (2) or moderately high surface rocks (class 3) (2)

Soil Classification: Orthic Sombric Brunisols (4)

Humus Classification: Vermimulls (3), Rhizomulls (2)

Depth of Ah Horizon: generally > 25 to 30 cm (4) Colour of Ah Horizon: normally dark, 10YR 2/1 (3), some dark and slightly brownish 10YR2/2 (2)

Depth to Bedrock: ordinarily none, or 5 to 30 cm (2)

Surface Soil Texture: usually silt loam (3), gravelly to very gravelly (3)

Percent Coarse Fragments: high coarse fragments in the subsurface horizons (55-80%) (4)

Comments: This plant community is probably not as visually obvious as the others. It was not directly recognized as a community in the field work, although its potential to form a group was recognized. This potential was then confirmed by a check of the data.

Discussion:

Medium to high subsurface coarse fragments partly distinguishes this community. It is not otherwise distinguished from c28a in its characteristics. It occurs mostly at low elevations, which partly differentiates from c28a and c29a, which are found at all elevations. This subcommunity is probably derived from c43, c41, c47, and possibly c42 and will degrade into c23, c28a and c5. It may have been less disturbed than c28a, or is a recovery stage. Another difference may be the seeding history of many sites.

There are discussion of similar communities in c28a for *Dactylis glomerata*, c43 for *Bromus carinatus*, c29a for *Vicia sativa* and *Poa pratensis*.

Interpretations:

Preservation Priority: moderately high by general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is moderate. Current regeneration is normal

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Grass species such as *Bromus carinatus* (California brome) are rated as moderately important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. There are also thermal bedding and foraging opportunities on moderate south to west slopes and some bedrock or rock exposure. *Sanicula crassicaulis* is used as fresh sprouts in spring by deer and other grazing animals. The large diameter oaks of this plant community provide tree hollows which are a focal habitat feature for raccoons (*Procyon lotor*). Earthworms and other rich soil attributes are provided by this community and are taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas

formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- high to very high by physiognomic type
- high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Camassia leichtlinii (great camas), present in moderate amounts, gives early season appeal with its flowering and interest value with its seed heads. Camas has cultural heritage value for its historic aboriginal use. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) are present in small to moderate amounts, providing some aesthetic value with their flowering and interest value with the pods of the vetches.

Susceptibility to Disturbance: moderately high

Prescribed Fire: The potential and need for the use of prescribed fire is high.

Threats: high to very high

Restoration Potential: moderate Restoration Priority: high

Special Management:

Bromus carinatus (California brome grass) has been used as cultivar. Selections should be made from the Garry oak habitat for use in restoration.

c30 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity

Ecosystem Description:

Frequency of Occurrence: 6 plots, infrequent

Distribution: From Plots: Saanich Peninsula: Uplands Pk., Summitt Pk., Panama Hill, Naden Hill; and western shore: Pedder Bay From Notes: Songhees: West Bay

Plant Community Description: *Dactylis glomerata* (introduced orchardgrass) and *Arrhenatherum elatius* (introduced tall oatgrass) occupy all sites, averaging class 3 and 4, respectively. The following three species grow on all sites: *Poa pratensis* (introduced Kentucky bluegrass) with class 3 cover, *Vicia sativa* (introduced common vetch) with class 2 or 3, and *Galium aparine* (cleavers) with class 1 cover. The remaining species are on most of the sites. *Bromus sterilis* (introduced barren barngrass) is class 1 to 2 cover. *Vicia hirsuta* (introduced hairy vetch) is class 2 to 3 cover, *Sanicula crassicaulis* (Pacific snakeroot) is class 2, and *Geranium molle* (introduced dovefoot geranium) is class 1 to 2.

Tree Canopy/ Landscape Expression: all are tree canopy (A) layer stands

Oak Characteristics: Diameters: primarily large- 67.5 to 106.3 cm (4);

Regeneration: Stocking averages light for both seedlings and saplings. Regeneration is present on some sites. Physiognomic Type: usually Oak - Grass - Parkland (2) or Oak - Light Shrub - Herb - Bulb Parkland (2).

Suggested Successional Status: Mature Disclimax from Mature Climatic Climax

Constant Cover Value: 0.52 Adjusted Motyka Comparison: 0.79 Oak - *Dactylis glomerata*: Typic subcommunity (c28a)

Elevation: usually low elevation (5) Slope: usually gentle slopes (5), one steep

Aspect: east, south, west Surface Shape: primarily straight (4)

Moisture Regime: usually mesic to submesic, but with some outliers (2)

Exposure: usually insolation Bedrock Geology: various

Surface Substrate Features: mainly without features

Soil Classification: Orthic Sombic Brunisols (4) or Regosols (2)

Humus Classification: Orthi Rhizomulls (3) or Vermimulls (3)

Depth of Ah Horizon: 5 to 20 cm (3) or > 20 to 25 cm (3)

Colour of Ah Horizon: chiefly dark, 10YR 2/1 or 2/1.5 (5)

Depth to Bedrock: generally without R (4), or 5 to 20 cm (2)

Surface Soil Texture: normally silt loam (4)

Percent Coarse Fragments: ordinarily low to medium (5)

Comments: The two dominant grasses are used in seeding, consequently the type is found partly on old pastures.

Discussion:

This subcommunity is on similar sites to the moister c28a sites, and drier sites than c49. It differs in seeding history and possibly in the history of their agricultural management. This subcommunity occurs mostly at low elevations, which partly distinguishes it from c28a and c29a, which are found at all elevations. It is nonetheless derived from part of the occurrence of 28a and will degrade into c5 with further disturbance.

Communities have not been described in the literature for these species. An *Arrhenatherum*/*Sherardia* community was described by Sugihara et al.(1987) for the Bald Hills oak woodlands. *Arrhenatherum elatius* was an important species in the *Cynosurus echinatus* provisional association from the Oregon "balds" (Aldrich, 1972). *Geranium molle* was a second species from c30 present. *Arrhenatherum elatius* (tall oatgrass) was widespread in the U.S. oak stands examined in my reconnaissance. Tall oatgrass has been recommended for seeding as livestock forage (Hall, 1956; Hedrick et al., 1959). *Arrhenatherum elatius* is a major dominant in Europe, where it is used to define Alliances (e.g. Mueller Dombois and Ellenberg, 1974). There is a discussion in c28a of *Dactylis glomerata*.

Interpretations:

Preservation Priority: low by general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is very low. Saplings and seedlings are only present on some sites. Saplings are only lightly-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.
- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Other stands have the following physiognomic type characteristics (Oak- Light Shrub Cover- Herb - Bulb Parkland):

- some thermal bedding and foraging on gentle and moderate south to west slopes
- foraging space, nectar, abundant numbers of bird species
- high numbers of tree habitat features
- some trees or stands with the following: high numbers of large dead limbs, high number of tree crevices/cavities, high number of perches; nesting opportunities, loose bark.

Sanicula crassicaulis is used as fresh sprouts in spring by deer and other grazing animals. The large diameter oaks of this plant community provide tree hollows which are a focal habitat feature for raccoons (*Procyon lotor*). I have observed Canada geese (*Branta canadensis*) feeding on *Arrhenatherum elatius* (tall oatgrass) seedheads in a lowland riparian setting. Earthworms and other rich soil attributes are provided by this community and are taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands

are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

Aesthetic / Recreational: Overall aesthetic appeal is rated as high, based on the following:

- high by physiognomic type
- high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Vicia sativa (introduced common vetch), *Geranium molle* (introduced dovefoot geranium) and *Vicia hirsuta* (introduced hairy vetch) are present in small/moderate to substantial amounts, providing some aesthetic value with their flowering and interest value with the pods of the vetches. This community often forms a part of a pastoral type landscape.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: very high

Restoration Potential: low

Restoration Priority: moderately high

Special Management: Vegetation management of the dense grass sward may be required to achieve successful regeneration of oak. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) are present in moderate to substantial amounts, and have the ability to fix atmospheric nitrogen. This ability could be put to use on certain sites where maintenance, not recovery, is the objective, or as a transitional measure for rehabilitative restoration.

c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity

Ecosystem Description:

Frequency of Occurrence: 5 plots

Distribution: From Plots: Saanich Peninsula: Glendale Lands, Saxe Pt.; and western shore: Juan de Fuca Pk., Mary Hill, Rocky Pt. From Notes none

Plant Community Description: *Dactylis glomerata* (introduced orchardgrass) and *Agrostis stolonifera* (introduced redtop) are on all sites and average class 3 to 4. *Vicia sativa* (introduced common vetch) and *Taraxacum officinale* (introduced dandelion) are present on most sites and average class 2 and 1, respectively.

Tree Canopy/ Landscape Expression: primarily tree canopy (A) layer (4)

Oak Characteristics: Diameters small (2) and large (3) (>80 cm);

Regeneration: Regeneration is present on most sites for both seedlings and saplings. Stocking averages light for both.

Physiognomic Type: various: some Oak - Grass Parkland (2)

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.34 Elevation: mostly low (4), one medium elevation

Slope: flat and gentle slopes Aspect: various

Surface Shape: chiefly concave (4) Moisture Regime: submesic to subhygric (4)

Exposure: wind (4), insolation (2), seaspray (2) Bedrock Geology: granitic (3)

Surface Substrate Features: some moderate to high bedrock exposure (2)

Soil Classification: Orthic Sombric Brunisols (2), Regosols (2), Orthic Humic

Gleysols (1) Humus Classification: Vermimulls (3)

Depth of Ah Horizon: 10 to 30 cm (one is an organic)

Colour of Ah Horizon: dark, 10YR2/1 (4) Depth to Bedrock: largely without (3)

Surface Soil Texture: mainly loam to silt loam (one clay-loam, one organic, some gravelly (3) Percent Coarse Fragments: low (0 to 30%) (4), some high (80%) subsurface coarse fragments (1)

Comments: This is the moister of the subcommunities in the *Dactylis glomerata* group. The two dominant grasses are used in seeding, consequently this type is partly found on old pastures.

Discussion:

Occurrence on moister sites than c28a and c49 distinguishes this subcommunity. It also differs in seeding history and possibly in the history of agricultural management. This subcommunity occurs partly in concave slope positions which receive additional moisture from the surrounding landscape. Occurrence partly on flat sites is also unique among the plant communities. It generally occurs at low elevations, which partly distinguishes it from c28a and c29a, which are found at all elevations, but it is nonetheless derived from c28a.

Plant communities with these species have not been described for oak woodlands. There is a discussion in c28a for *Dactylis glomerata*.

Interpretations:

Preservation Priority: low by general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is low. Saplings are only lightly-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak- Grass- Parkland) to which this plant community has been assigned:

- seeds, foraging space, grasshoppers, moderately attractive fresh sprouts.

- indications of high number of bird species, high average numbers of wildlife use and habitat features, high total numbers of tree habitat features, high number of perches, small and medium dead limbs, scaling limbs, high numbers of loose bark occurrences and bark crevices.
- some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

The large diameter oaks of this plant community provide tree hollows which are a focal habitat feature for raccoons (*Procyon lotor*). Earthworms and other rich soil attributes are provided by this community and are taken advantage of by American robins (*Turdus migratorius*), the most frequent bird species of my 1993 sampling. Deep soil lowlands are also habitat for Townsend's vole (*Microtus townsendi tetramerus*). Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. The abundance of seeds produced from this grassy community is particularly attractive to bird species such as dark eyed junco (*Junco hyemalis*), the fourth most frequent species in my 1993 sampling; white crowned sparrow (*Zonotrichia leucophrys*), the eighth most frequent; and California quail (*Callipepla californica*), the 10th most frequent.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high, based on the following:

- high by physiognomic type
- low to high by oak diameter (size class)

- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Although introduced, *Agrostis stolonifera* in its "redtop phase" adds appeal to this community. *Vicia sativa* (introduced common vetch) is present in moderate amounts, providing some aesthetic value with its flowering and interest value with its pods. This community often forms a part of a pastoral type landscape.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is moderate.

Threats: very high

Restoration Potential: low

Restoration Priority: moderately high

Special Management:

Vicia sativa (introduced common vetch) is present in moderate amounts, and has the ability to fix atmospheric nitrogen. This ability could be put to use on certain sites where maintenance, not recovery, is the objective, or as a transitional measure for rehabilitative restoration.

c3 Oak - Broom - *Rhacomitrium canescens* - *Festuca bromoides* - *Aira* subcommunity

Ecosystem Description:

Frequency of Occurrence: 10 plots, frequent

Distribution: From Plots: Saanich Peninsula: Skirt Mt., Observatory Hill, Mt. Doug., Glendale Lands, Summit Pk., Naden Hill; western shore: Juan de Fuca Pk., Lester Pearson College, Mary Hill. From Notes: Galiano Is.: Mt. Galiano; Saanich Peninsula: Knockan Hill.

Plant Community Description: *Cytisus scoparius* (introduced broom) thrives on all sites, generally as a low shrub (B2), but sometimes as a tall shrub (B1). Its cover averages class 4 for the former and class 2 for the latter. *Rhacomitrium canescens* (gray frayed-cap moss) occupies most sites and averages class 3 to 4 cover. *Festuca*

bromoides (introduced annual fescue) grows on all sites and averages class 4. *Aira praecox* (introduced early hairgrass) and *Aira caryophyllea* (introduced silver hairgrass) occur on most sites and average class 2 cover. *Rumex acetosella* (introduced sheep sorrel) is present on all sites and averages cover class 1. The remaining species exist on most sites. *Cynosurus echinatus* (introduced dogtail bristlegrass), *Bromus sterilis* (introduced barren barngrass), *Elymus glaucus* (blue wildrye) and *Bromus mollis* (introduced soft brome grass) average class 2 cover. *Galium aparine* (cleavers) averages class 1 to 2 cover.

Tree Canopy/ Landscape Expression: tall shrub (B1) canopy (6), or tree canopy (A) layer (4)

Oak Characteristics: Diameters: various (10.9 to 55.2 cm);

Regeneration: Regeneration is occurring on most sites for saplings and all sites for seedlings. Saplings average moderate stocking and seedlings average light to moderate stocking.

Physiognomic Type: usually Shrub Oak - Broom - Rockland (6).

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.75

Adjusted Motyka Comparison: 1.44 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity (c50); 1.02 Oak- Broom- *Rhacomitrium canescens*: Typic subcommunity (c17).

Elevation: various elevations, low to high, 10 to 210 m

Slope: usually moderate to steep Aspect: usually south to west

Surface Shape: usually convex Moisture Regime: usually subxeric (2) to very xeric (5)

Exposure: insolation, often wind (6) Bedrock Geology: various

Surface Substrate Features: all plots have either moderate to very high bedrock exposure (class 3 to 6) or moderately high surface rocks (class 3) (2)

Soil Classification: Orthic Sombric Brunisols, Regosols

Humus Classification: usually Rhizomulls Depth of Ah Horizon: often shallow (6): 3 to 6 cm Colour of Ah Horizon: usually dark: 10YR2/1 (7)

Depth to Bedrock: usually shallow, 3 to 7 cm (6), 25 cm (1)

Surface Soil Texture: often silt loam or gravelly silt loam (6)

Percent Coarse Fragments: various

Discussion:

This subcommunity is partly distinguished by its very shallow, silt loam textured soils over bedrock. It is generally more xeric than c22 and is derived from c50, ultimately from c46.

Communities have not been classified for broom (*Cytisus scoparius*) in the literature on oak woodlands, but it is widespread and dominant in many areas. *Aira caryophyllea* was present in the *Lomatium martindalei* provisional association from the Oregon "balds" (Aldrich, 1972). There is a discussion in c46 for *Rhacomitrium canescens* and c50 for *Festuca bromoides* and *Aira praecox*.

Interpretations:

Preservation Priority: medium by general ranking.

Regeneration: Regeneration potential is high. Seedlings are present on all sites and are lightly- to moderately-stocked. Otherwise normal.

Wildlife Habitat and Use: Most stands have the physiognomic type, Shrub oak-Broom- Rockland, with the following characteristics.

- high average numbers of wildlife and wildlife habitat attributes, high scat numbers, thermal south slopes and bedrock or rock exposure for bedding and foraging, visual security bedding, escape terrain, dense, low cover for hiding and security in shrub oak.
- potential for chaparral bird species
- increase in food for foliage gleaners from relatively more insect outbreaks.
- browse and seeds for wildlife, and dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all from broom.

- rock crevices
- high numbers of: tree features, crevices/cavities, perches, loose bark.

This community has some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Cytisus scoparius (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important as I recorded many spring utilization records. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling. Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sarah orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderate, based on the following:

- moderate by physiognomic type

- low to high by oak diameter (size class)
- moderately high by form-class within physiognomic type
- moderately low by oak form-complexity within physiognomic type

Cytisus scoparius (introduced broom) generally reduces aesthetic appeal, the exception being stands at lower densities, when broom does have some appeal for its flowering and interest value for its pods. *Aira praecox* (introduced early hairgrass) and *Aira caryophylla* (introduced silver hairgrass) may have some interest and aesthetic value for their early growth and heading out. This plant community is often on hilltops which are the destination of hikers, birders and naturalists. Awns and calluses of weedy grasses reduce recreation enjoyment by lodging in hiker's socks and bothering them.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is low, and often not advisable.

Threats: high

Restoration Potential: moderate

Restoration Priority: moderate

Special Management:

Consideration should be given to *Allium acuminatum*, a species with yellow (potentially vulnerable) status, which this community seems to provide habitat for. *Cytisus scoparius* (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin.

c17 Oak - Broom - *Rhacomitrium canescens*: Typic subcommunity

Ecosystem Description:

Frequency of Occurrence: 3 plots, locally frequent

Distribution: From Plots: Saanich Peninsula: Scafe Hill, Songhees; western shore: Colwood DND From Notes: Ladysmith: Woodley Range; Saltspring Is.: Ruckle Pt.; Saanich Peninsula: Uplands, Saxe Pt.; western shore: Mill Hill.

Plant Community Description: *Cytisus scoparius* (introduced broom) is present on all sites as a low shrub (B2), but sometimes also as a tall shrub (B1). Its cover is marginal, averaging class 2 to 3 for the former and class 1 for the latter. *Rhacomitrium canescens* (gray frayed-cap moss) thrives on most sites and averages class 4 in cover.

Rumex acetosella (introduced sheep sorrel) and *Brodiaea coronaria* (harvest brodiaea) exist on all sites and average cover class 1. *Galium aparine* (cleavers), *Aira praecox* (introduced early hairgrass) and *Selaginella wallacei* grow on all sites and average cover class 1 to 2, 2 and 2, respectively.

The remaining species occupy most sites. *Symphoricarpos albus* (snowberry), *Elymus glaucus* (blue wildrye), *Bromus mollis* (introduced soft brome grass), *Bromus tectorum* (introduced cheatgrass), *Anthoxanthum odoratum* (introduced sweet vernalgrass), *Camassia leichtlinii* (great camas), *Vicia sativa* (introduced common vetch), *Lotus micranthus* (small flowered lotus) and *Polytrichum juniperinum* (juniper haircap moss) average cover class 2.

Mahonia aquifolium (tall Oregon grape), *Luzula multiflora* (many-flowered woodrush), *Bromus sterilis* (introduced barren barngrass), *Collinsia parviflora* (small flowered blue-eyed Mary), *Stellaria media* (introduced chickweed) and *Veronica serpyllifolia* (thyme-leaved speedwell) average cover class 1.

Tree Canopy/ Landscape Expression: tall shrub (B1) layer canopy

Oak Characteristics: Diameters: small; Regeneration: Sapling regeneration was present on all sites, seedlings on most sites. Stocking averages moderate for both.

Physiognomic Type: usually Shrub Oak- Rock Outcrop (2).

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.71 Adjusted Motyka Comparison: 1.66 Oak- Broom-*Rhacomitrium canescens* - *Bromus tectorum* subcommunity (c22); 1.02 Oak- Broom-*Rhacomitrium canescens*- *Festuca bromoides* - *Aira* subcommunity (c3); 0.86 Oak-*Rhacomitrium canescens* - *Selaginella wallacei* (c46)

Elevation: low elevation (2), high elevation (1)

Slope: moderate to very steep Aspect: south to southwest

Surface Shape: convex Moisture Regime: very xeric

Exposure: insolation, wind (2) Bedrock Geology: coarse: granitic, conglomerate

Surface Substrate Features: all plots have high or very high surface bedrock exposure (class 3 to 6) Soil Classification: Orthic Humic Regosols (2), Orthic Regosols (1)

Humus Classification: Rhizomulls (2), Xeromulls (1)

Depth of Ah Horizon: 2 to 10 cm (2), > 25 cm (1)

Colour of Ah Horizon: dark, 10YR2/1 Depth to Bedrock: 7 to 10 cm (2), 40 cm (estimated) (1) Surface Soil Texture: sandy loam (2), gravelly to very gravelly

Percent Coarse Fragments: moderate to high (35 to 60 %)

Comments: This plant subcommunity was identified in the field and sampled as a non- or lesser- broom type, before re-grouping in the analysis with the broom types.

Discussion:

Occurrence on very shallow, sandy loam textured soils over coarse bedrock and on some very steep low elevation slopes partly distinguishes this community. It is derived from c46.

For similar communities, see the discussion in c46 for *Rhacomitrium canescens* and c50 for *Aira praecox*.

Interpretations:

Preservation Priority: medium by general ranking.

Regeneration: Regeneration potential is high. Saplings present on all sites. Seedlings are moderately-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Shrub oak- Rock Outcrop) to which this plant community has been assigned:

- indications of high utilization, high average numbers of wildlife use and wildlife habitat attributes, high numbers of bedrock and rock crevices and burrows.

- potential for attracting chaparral species
- increased food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- visual security and some thermal bedding, escape terrain, fresh sprouts, seeds, nectar, grasshoppers
- high total numbers of tree wildlife habitat features, high numbers of: perches, loose bark occurrences, scaling limbs, small and medium dead limbs.

Stands will also typically have browse and seeds for wildlife, and dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all from broom.

The rockiness and exposure provides habitat for garter snakes and northern alligator lizards (*Gerrhonotus coeruleus*). The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*). *Cytisus scoparius* (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important as I recorded many spring utilization records. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but seem to be higher, for several spring utilization records were detected in the surveying. *Brodiaea coronaria* is heavily preferred as fresh sprouts in spring by deer and other grazing animals.

Symphoricarpos albus (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth

most frequent in my 1993 sampling. Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sara orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Lotus micranthus* (small-flowered lotus) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), which uses *Lotus*. Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high, based on the following:

- moderate to high by physiognomic type
- low by oak diameter (size class)
- high by form-class within physiognomic type
- moderately low by oak form-complexity within physiognomic type

Selaginella wallacei (Wallace's selaginella), present in small to moderate amounts, enhances later season aesthetics by remaining green into the summer. *Cytisus scoparius* (introduced broom) generally reduces aesthetic appeal, the exception being stands at lower densities, when broom does have some appeal for its flowering and interest value for its pods. *Symphoricarpos albus* (snowberry), present in moderate amounts, adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Camassia leichtlinii* (great camas), present in moderate amounts, gives early season appeal with its flowering and interest value with its seed heads. Camas has cultural heritage value for its historic aboriginal use. *Brodiaea coronaria* (harvest brodiaea) and *Collinsia parviflora* (small flowered blue-eyed Mary), although present in small quantities, add some aesthetic appeal with their late and early season (respectively) flowering. This plant community is often on hilltops which are the destination of hikers, birders and naturalists. Awns and calluses of weedy grasses reduce recreation enjoyment by lodging in hiker's socks and bothering them.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is low, and often not advisable.

Threats: high

Restoration Potential: moderate

Restoration Priority: moderate

Special Management:

Cytisus scoparius (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin. *Lotus micranthus* (small-flowered lotus), present in moderate quantities, is important for recovery in its ability to fix atmospheric nitrogen. Consideration should be given to this species, along with *Brodiaea coronaria* (harvest brodiaea), present in small amounts, which have yellow (potentially vulnerable) status. Harvest brodiaea is cultivated and used in native plant gardening.

c22 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum* subcommunity

Ecosystem Description:

Frequency of Occurrence: 4 plots, infrequent

Distribution: From Plots: Pender Island: George Hill; Saanich Peninsula: Water Tower Hill, Bear Hill; western shore: Juan de Fuca Pk. From Notes: Cowichan Bay, Pender Is.: Stanford Hill; Saanich Peninsula: Observatory Hill.

Plant Community Description: *Rhacomitrium canescens* (gray frayed-cap moss) and *Cytisus scoparius* (introduced broom) thrive on all sites, and average class 4 cover, the latter as a low shrub (B2). *Bromus tectorum* (introduced cheatgrass) occupies all sites and averages class 3.

Bromus mollis (introduced soft brome grass) and *Bromus sterilis* (introduced barren barngrass) grow on all sites, and average cover class 3. The remaining species are present on most sites. *Festuca bromoides* (introduced annual fescue), *Aira praecox* (introduced early hairgrass), *Vicia sativa* (introduced common vetch), *Galium aparine* (cleavers), and *Trifolium tridentatum* (tomcat clover) average class 2 cover.

Elymus glaucus (blue wildrye) and *Lotus micranthus* (small flowered lotus)

average class 1 or 2. *Mahonia aquifolium* (tall Oregon grape), *Brodiaea coronaria* (harvest brodiaea) and *Sanicula crassicaulis* (Pacific snakeroot) average cover class 1.

Tree Canopy/ Landscape Expression: tree canopy (A) layer (2), or tall shrub (B1) canopy (2)

Oak Characteristics: Diameters: various; Regeneration: Regeneration is occurring on all sites for both saplings and seedlings. Stocking of saplings averages moderate, and averages light for seedlings.

Physiognomic Type: Oak - Broom - Parkland (2) or Shrub Oak - Rock Outcrop (2).

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.76 Adjusted Motyka Comparison: 1.66 Oak- Broom-
Rhacomitrium canescens: Typic subcommunity (c17);

Elevation: usually high elevation (3) Slope: usually moderately steep or steep (3)

Aspect: southwest (south to west) Surface Shape: convex

Moisture Regime: normally subxeric to very xeric Exposure: insolation, some wind

Bedrock Geology: coarse: granitic, sandstone

Surface Substrate Features: most plots have either moderate to very high bedrock exposure (class 3 to 6) (3) or moderately high surface rocks (class 3) (3)

Soil Classification: Orthic Regosols (2), and Orthic Sombric Brunisols (2)

Humus Classification: Vermimulls (2) or Rhizomulls (2)

Depth of Ah Horizon: 4 to 20 cm Colour of Ah Horizon: 10YR2/1

Depth to Bedrock: usually shallow (4 to 25 cm) (3)

Surface Soil Texture: loam to silt loam, gravelly

Percent Coarse Fragments: low (20 to 25 %) (2), or very high coarse fragments (80%) at depth (2)

Comments: This plant community was reassigned as a subcommunity after comparison with the Oak - Broom - *Rhacomitrium canescens*: Typic subcommunity (c17). The ground layer portion of c22 is more typical of open areas away from the oaks.

Discussion:

This subcommunity is partly distinguished by its shallow soils over bedrock and its occurrence on high elevation sites with moderate to very high surface exposure of bedrock or coarse fragments. This community is generally less xeric than c3 and it is thought to be derived from c46, possibly via c50.

Communities have not been described for *Bromus tectorum* in the literature on oak woodlands although this widespread weedy grass was used by Williams (1978) as a negative indicator of condition in his interior *Quercus garryana* communities in the Mt. Hood area of Oregon. This community may be related to a *Bromus rigidus/moss* grassland community described by Salstrom (1989) for Pt. Disney, Waldron Island, Washington. *Bromus tectorum* was present on some plots with a substantial cover. *Bromus tectorum* is an invader species controlling many interior plant communities of the Pacific Northwest (Erickson, 1977). *Bromus tectorum* was a dominant of grasslands associated with oak at Whistler's Bend on the Umpqua River, Oregon and of my plot AP01 on the Alderpoint Road in the Bald Hills oak woodland, California.

There is a discussion in c46 for *Rhacomitrium canescens* and c50 for *Aira praecox*.

Interpretations:

Preservation Priority: medium by general ranking.

Regeneration: Regeneration potential is moderate. Saplings and seedlings are present on all sites. Otherwise normal.

Wildlife Habitat and Use: Most stands have the physiognomic type, Shrub oak-Broom- Rockland, with the following characteristics.

- high average numbers of wildlife and wildlife habitat attributes, high scat numbers, thermal south slopes, bedrock and rock exposure for bedding and foraging, visual security bedding, escape terrain, dense, low cover for hiding and security in shrub oak.
- potential for chaparral bird species

- increase in food for foliage gleaners from more relatively insect outbreaks.
- browse and seeds for wildlife, and dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all from broom.
- rock crevices
- high numbers of: tree features, crevices/cavities, perches, loose bark.

This community has some trees or stands with large tree attributes- bark glean, foliage glean, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, hollow logs or tree hollows.

Some stands have the following characteristics associated with a secondary physiognomic type (Shrub oak- Rock Outcrop):

- indications of high utilization, high numbers of bedrock and rock crevices and burrows.
- fresh sprouts, seeds, nectar, grasshoppers
- high numbers of: scaling limbs, small and medium dead limbs.

The rockiness and exposure provide habitat for garter snakes and northern alligator lizards. The grasshoppers and crickets of this community are a particularly attractive food source for northern alligator lizards (*Gerrhonotus coeruleus*) as they would formerly have been for western bluebirds (*Sialia mexicana*). *Cytisus scoparius* (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important as I recorded many spring utilization records. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but seems to be higher based on several spring utilization records. *Brodiaea coronaria* is heavily preferred as fresh sprouts in spring by deer and other grazing animals. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta*

thalassina); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. *Symphoricarpos albus* (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. These settings are patrolled by golden eagles (*Aquila chrysaetos*), red tailed hawk (*Buteo jamaicensis*) and the blue-listed turkey vultures (*Cathartes aura*) and hawked over (from perches) by olive-sided flycatcher (*Nuttallornis borealis*), the 11th most frequent bird species in the 1993 sampling. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent; and yellow rumped warbler (*Dendroica coronata*), the twelfth.

Rocky knolls, such as those on which this community occurs, provide habitat for butterflies such as sarah orange-tip (*Anthocaris sora flora*) and anise swallowtail (*Papilio zelicaon*). Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Lotus micranthus* (small-flowered lotus) is probably a larval food for silvery blue (*Glaucopsyche lygadamus*), which uses *Lotus*. *Trifolium tridentatum* (tomcat clover) is probably a larval food plant for northern cloudywing (*Thorybes pylades*) and the endangered greenish blue (*Plebejus saepiolus insulanus*), both of which use *Trifolium*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderately high, based on the following:

- low to moderate by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

Cytisus scoparius (introduced broom) generally reduces aesthetic appeal, the exception being stands at lower densities, when broom does have some appeal for its

flowering and interest value for its pods. *Symphoricarpos albus* (snowberry), present in moderate amounts, adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Camassia leichtlinii* (great camas), present in moderate amounts, gives early season appeal with its flowering and interest value with its seed beads. Camas has cultural heritage value for its historic aboriginal use. *Trifolium tridentatum* (tomcat clover) and *Brodiaea coronaria* (harvest brodiaea), although present in small to moderate amounts, give some appeal with their mid and late season flowering. This plant community is often on hilltops which are the destination of hikers, birders and naturalists. Awns and calluses of weedy grasses reduce recreation enjoyment by lodging in hiker's socks and bothering them.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is low, and often not advisable.

Threats: moderately high

Restoration Potential: moderate Restoration Priority: moderate

Special Management: *Cytisus scoparius* (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin. *Lotus micranthus* (small-flowered lotus) and *Trifolium tridentatum* (tomcat clover), present in small to moderate quantities, are important for restoration due to their ability to fix atmospheric nitrogen. Consideration should be given to these species, along with *Brodiaea coronaria* (harvest brodiaea) and *Triteleia hyacinthina*, which this community seems to provide habitat for, which have with yellow (potentially vulnerable) status. Harvest brodiaea is cultivated and used in native plant gardening.

c2 Oak - Broom - *Cynosurus echinatus* (late season)

Ecosystem Description:

Frequency of Occurrence: 6 plots, moderately frequent

Distribution: From Plots: fairly widespread: Galiano Island: Salalikim Rock; Saanich Peninsula: Lone Tree Hill, Mt. Finlayson, Observatory Hill; western shore: Mill Hill, Lester Pearson College From Notes: Skirt Mt.

Plant Community Description: *Cytisus scoparius* (introduced broom) thrives on all sites and averages high cover (class 5) in the low shrub (B2) layer. There is also some tall shrub (B1) occurrence, which averages class 2 cover. *Cynosurus echinatus* (introduced dogtail bristlegrass) occupies all sites and averages class 4 cover. *Festuca bromoides* (introduced annual fescue) grows on all sites and averages class 3. The remaining species are present on most sites. *Bromus sterilis* (introduced barren barngrass), *Galium aparine* (cleavers), and *Sanicula crassicaulis* (Pacific snakeroot) average cover class 2. *Aira caryophyllea* (introduced silver hairgrass) and *Elymus glaucus* (blue wildrye) average class 1 to 2.

Tree Canopy/ Landscape Expression: some tree layer (A) canopy (3), one sparse tree layer canopy, some tall shrub (B1) layer canopy (2)

Oak Characteristics: Diameters: various; Regeneration: Sapling regeneration is present on most sites. Seedling regeneration occurs on some sites. Stocking of saplings averages moderate. Seedlings are (very) lightly-stocked.

Physiognomic Type: Oak - Broom - Parkland (4) and Shrub Oak - Broom - Rockland (2). Suggested Successional Status: Mature Disclimax on Mature Edaphic Climax sites.

Constant Cover Value: 0.60 Adjusted Motyka Comparison: 0.53 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum* subcommunity (c22); 0.51 Oak - *Cynosurus echinatus* (c21); 0.38 Oak - *Mahonia aquifolium* (c26); 0.15 Oak - *Bromus sterilis* (c23); 0.09 Oak - *Elymus glaucus* (c47); 0.08 Oak - *Lonicera hispidula* (c16a).

Elevation: ordinarily high elevation (4), some low and medium elevation (3)

Slope: usually moderate to moderately steep slopes, some gentle slopes (2)

Aspect: chiefly south (4) Surface Shape: various

Moisture Regime: largely subxeric to xeric (ranges from submesic to very xeric)

Exposure: insolation, wind Bedrock Geology: various

Surface Substrate Features: most plots (6) have either moderate to high bedrock exposure (class 3 or 4) (4) or moderate to high surface rocks (2).

Soil Classification: mainly Orthic Sombric Brunisols (4)

Humus Classification: Orthi Rhizomulls (5)

Depth of Ah Horizon: usually greater than 25 or 30 cm (4)

Colour of Ah Horizon: usually dark or dark and slightly brownish: 10YR2/1, 2/2

Depth to Bedrock: primarily without (3), or 8 cm to 50 cm (estimated) (3)

Surface Soil Texture: various Percent Coarse Fragments: most have high coarse fragments (60 to 85%) in subsurface horizons

Comments: The dominant *Cynosurus echinatus* has a late season of growth. Most plots are described between May 14 and June 22. There is one early season plot, so the type can be detected in early season, but it is more difficult.

Discussion:

Deep dark *Ah* horizons, high subsurface coarse fragments, and occurrence on high elevation sites with moderate to high surface exposure of bedrock or coarse fragments partly distinguish this community. Slopes are generally less steep (moderate) than the previous three plant communities. This community is derived from c21, ultimately from c27, c20 and c25. For similar communities, see the discussion of *Cynosurus echinatus* in c21.

Interpretations:

Preservation Priority: very low by the general ranking.

Regeneration: Regeneration potential is moderately low. Seedlings are only present on some sites and stocking is very light.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak - Broom -Parkland) to which this plant community has been assigned:

- high average numbers of wildlife habitat and use records, high numbers of utilization detections, high numbers of bird species recorded

- browse and seeds for wildlife, dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all provided by broom
- highest numbers of tree wildlife habitat features, large diameter oaks, with large tree features, high numbers of bark crevices, high numbers of small and medium and scaling dead limbs, bark glean, foliage glean, perching, nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows

Some stands additional characteristics associated with the physiognomic type, Shrub oak- Broom- Rockland:

- high scat numbers, thermal south slopes and bedrock or rock exposure for bedding and foraging, visual security bedding, escape terrain; dense, low cover for hiding and security in shrub oak.
- potential for chaparral bird species
- increase in food for foliage gleaners from relatively more insect outbreaks.
- rock crevices
- high numbers of: crevices/cavities, perches, loose bark.

Cytisus scoparius (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important as I recorded many spring utilization records. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by deer and other animals. The rockiness and exposure provide habitat for garter snakes and northern alligator lizards. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still

provide the cavities and other resources for possible reintroductions. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent in my 1993 sampling.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderate to moderately high, based on the following:

- low to moderate by physiognomic type
- low to high by oak diameter (size class)
- moderately high to high by form-class within physiognomic type
- moderately low to moderately high by oak form-complexity within physiognomic type

Cytisus scoparius (introduced broom) generally reduces aesthetic appeal, the exception being stands at lower densities, when broom does have some appeal for its flowering and interest value for its pods. This plant community is often on hilltops which are the destination of hikers, birders and naturalists. Awns and calluses of weedy grasses reduce recreation enjoyment by lodging in hiker's socks and bothering them.

Susceptibility to Disturbance: low

Prescribed Fire: The potential and need for the use of prescribed fire is low and not advisable.

Threats: moderately high

Restoration Potential: low

Restoration Priority: low

Special Management: *Cytisus scoparius* (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin. Tree protection devices or other measures may be required against deer browsing if adequate regeneration is to be achieved. Consideration should be given to *Allium acuminatum*, a species with yellow (potentially vulnerable) status,

which this community seems to provide habitat for. Some broom control may be required to achieve successful oak regeneration.

c31b Oak - Broom - *Anthoxanthum odoratum*

Ecosystem Description:

Frequency of Occurrence: 3 plots, infrequent

Distribution: From Plots: Saturna Island: Elliott Bluff; Thetis Lake.

From Notes: none

Plant Community Description: *Cytisus scoparius* (introduced broom) thrives on all sites as a low shrub (B2), and some stands as a tall shrub (B1). Low shrub (B2) cover is high, averaging class 5. Tall shrub cover averages class 2. *Anthoxanthum odoratum* (sweet vernalgrass) occupies all sites, with cover averaging class 4.

Poa pratensis (introduced Kentucky bluegrass), *Sanicula crassicaulis* (Pacific snakeroot), and *Rhytidiadelphus triquetrus* (electric cats-tail moss) grow on all sites and average cover class 2. *Elymus glaucus* (blue wildrye), *Bromus carinatus* (California brome), *Luzula multiflora* (many-flowered woodrush), *Montia perfoliata* (perfoliate-leaved miners lettuce), and *Vicia sativa* (introduced common vetch) are present on all sites and average cover class 1.

The remaining species exist on most sites. *Symphoricarpos albus* (snowberry) averages cover class 3. *Lonicera hispidula* (hairy honeysuckle), *Festuca bromoides* (introduced annual fescue), *Bromus sterilis* (introduced barren barngrass), *Bromus mollis* (introduced soft brome), *Galium aparine* (cleavers), *Plectritis congesta* (seablush), *Rhacomitrium canescens* (gray frayed-cap moss), and *Eurhynchium oregonum* (moss) average class 2 cover. *Daphne laureola* (introduced daphne), *Melica subulata* (oniongrass), *Aira praecox* (introduced early hairgrass), *Dactylis glomerata* (introduced orchardgrass), *Collinsia parviflora* (small flowered blue-eyed Mary), *Veronica serpyllifolia* (thyme-leaved speedwell), *Dodecatheon hendersonii* (broad-leaved shootingstar), *Stellaria nitens* (starwort), *Stellaria media* (introduced chickweed), *Myosotis discolor* (introduced forget-me-not), *Hypochaeris radicata*

(introduced hairy cats ear), *Sherardia arvensis* (introduced blue field madder), *Geranium molle* (introduced dovefoot geranium), *Plantago lanceolata* (introduced narrow leaved plantain), *Teesdalia nudicaule* (introduced teesdalia), and *Vicia hirsuta* (introduced hairy vetch) average cover class 1.

Tree Canopy/ Landscape Expression: tall shrub (B1) canopy layer (2), one tree canopy (A) layer

Oak Characteristics: Diameters: various: 12.6 to 45.2 cm;

Regeneration: Regeneration is present for saplings on most sites, and for seedlings on all sites. Stocking is moderately to well-stocked for saplings, and light for seedlings.

Physiognomic Type: various of the broom series.

Suggested Successional Status: Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.83 Adjusted Motyka Comparison: none

Elevation: medium elevation Slope: gentle slopes

Aspect: southwest to west Surface Shape: various

Moisture Regime: submesic to subxeric Exposure: insolation (2)

Bedrock Geology: basalt (2) Surface Substrate Features: all plots have moderately high to very high bedrock exposure (class 3 to 6)

Soil Classification: Orthic Sombric Brunisols

Humus Classification: Orthi Rhizomulls (2), Orthi Vermimulls (1)

Depth of Ah Horizon: > 30 cm (2), 10 cm (1)

Colour of Ah Horizon: dark, 10YR2/1 to dark and slightly brownish 10YR2/2

Depth to Bedrock: none (2), 15 cm (1) Surface Soil Texture gravelly silt loam (2)

Percent Coarse Fragments: low to medium

Discussion:

This plant community is partly distinguished by its deep, dark *Ah* horizons and its occurrence on medium elevation sites with moderately high to very high exposure of bedrock or coarse fragments. It is derived from c31a, ultimately from c47, c43, c13,

and an unclassified Oak - *Danthonia californica* basin type. There is a discussion of similar communities in c31a for *Anthoxanthum odoratum*.

Interpretations:

Preservation Priority: very low by the general ranking.

Regeneration: Regeneration potential is moderately high. Seedlings are present on all sites. Sapling stocking is above average: moderately well- to well-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak - Broom -Parkland) to which this plant community has been assigned:

- high average numbers of wildlife habitat and use records, high numbers of utilization detections, high numbers of bird species recorded
- browse and seeds for wildlife, dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all provided by broom
- highest numbers of tree wildlife habitat features, some large diameter oaks with large tree features, high numbers of bark crevices, high numbers of small and medium and scaling dead limbs, bark glean, foliage glean, perching nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows

Some stands have the following physiognomic type characteristics (Shrub oak- Basin-Broomland):

- potential habitat for chaparral bird species
- increased in food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- rich soil resources (earthworms), nectar

There are also thermal bedding and foraging opportunities on gentle to moderate south and west facing slopes and bedrock exposure. *Cytisus scoparius* (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important

as I recorded many spring utilization records. *Sanicula crassicaulis* (Pacific snakeroot) is used as fresh sprouts by deer and other animals. The rockiness and exposure provide habitat for garter snakes, especially in moister basin and receiving site occurrences. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage for Coast deer, but seems to be higher based on several spring utilization records. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent.

Lonicera hispidula and *Symphoricarpos albus* (snowberry) are noted nectar producers for rufous and Anna's hummingbird, and probably for butterflies. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*).

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderate based on the following:

- low by physiognomic type
- low to moderate by oak diameter (size class)
- low to high by form-class within physiognomic type
- moderately high to moderately high by oak form-complexity within physiognomic type

Cytisus scoparius (introduced broom) generally reduces aesthetic appeal, the

exception being stands at lower densities, when broom does have some appeal for its flowering and interest value for its pods. *Lonicera hispidula* (hairy honeysuckle) has showy flowers which attract colourful hummingbirds and probably butterflies. *Symphoricarpos albus* (snowberry), present in moderate to substantial amounts, adds to aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Plectritis congesta* (seablush), *Collinsia parviflora* (small flowered blue-eyed Mary) and *Dodecatheon hendersonii* (broad-leaved shootingstar), present in small to moderate amounts, provide some appeal with their early season flowering. There is some detriment from the awns and calluses of weedy grasses which lodge in hiker's socks and bother them.

Susceptibility to Disturbance: low

Prescribed Fire: The potential and need for the use of prescribed fire is low and not advisable, except for trial sites with specific conditions.

Threats: moderately high

Restoration Potential: low

Restoration Priority: moderate for the potential *Danthonia californica* type.

Special Management:

Cytisus scoparius (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin. Control may be required of *Daphne laureola* (introduced daphne).

c6 Oak - Broom - *Elymus glaucus*

Ecosystem Description:

Frequency of Occurrence: 6 plots, moderately frequent

Distribution: From Plots: Galiano Island: Salalikim Rock; Saanich Peninsula: Observatory Hill, Mt. Doug, Knockan Hill; western shore: Mill Hill, Colwood DND.

From Notes: Galiano Is.: Mt. Galiano; Pender Is.: George Hill; Saanich Peninsula: Glendenning Rd., Florence Lk.; western shore: Ft. Rodd Hill, Mary Hill.

Plant Community Description: *Cytisus scoparius* (introduced broom) thrives on all sites as a low shrub (B2) and on some sites as a tall shrub (B1), averaging class 4

and 2 cover, respectively. *Elymus glaucus* (blue wildrye) occupies all sites, and averages class 3 cover.

Vicia sativa (introduced common vetch) and *Festuca bromoides* (introduced annual fescue) grow on all sites and average class 2 and 3 cover, respectively. The remaining species occur on most sites. *Bromus sterilis* (introduced barren brome) averages class 2 to 3 cover. *Galium aparine* (cleavers) and *Osmorhiza chilensis* (sweet cicely) average class 2 cover. *Bromus carinatus* (California brome) and *Sanicula crassicaulis* (Pacific snakeroot) average class 1.

Tree Canopy/ Landscape Expression: either tree canopy (A) layer or tall shrub (B1) canopy layer

Oak Characteristics: Diameters: small diameter; Regeneration: Regeneration is present on most sites for saplings and all sites for seedlings. Saplings are moderately well- to well-stocked. Seedlings are moderately well-stocked.

Physiognomic Type: usually Oak - Broom - Parkland (2) or Shrub Oak - Basin Broomland.

Suggested Successional Status: Mature Disclimax from Mature Edaphic Climax

Constant Cover Value: 0.53 Adjusted Motyka Comparison: 1.12 Oak- Broom- *Poa pratensis* (c4); 0.60 Oak- *Elymus glaucus* (c47)

Elevation: various: 3 are high elevation Slope: usually moderately steep to very steep, two plots are on gentle or moderate slopes Aspect: usually southwest

Surface Shape: various Moisture Regime: submesic to subxeric (xeric)

Exposure: insolation, usually wind (4)

Bedrock Geology: usually coarse: granitic or conglomerate

Surface Substrate Features: most (4) have either moderately high bedrock exposure (class 3) (3) or moderately high surface rocks (2)

Soil Classification: generally Orthic Sombric Brunisols (4)

Humus Classification: normally Rhizomulls (3) and Vermimulls (2)

Depth of Ah Horizon: 8 to > 30 cm Colour of Ah Horizon: ordinarily dark, 10YR2/1 Depth to Bedrock: various: two are shallow (4, 8 cm), two are 60 cm

(estimated), 80 cm (estimated), two are without indications of bedrock

Surface Soil Texture: coarse: loamy sand to loam, several are very gravelly (3)

Percent Coarse Fragments: usually high (60 to 90 %) in subsurface horizons (4)

Comments: understory could be transitional, or has resisted full invasion by adventive species. Possibly less disturbed than others in the broom series.

Discussion:

Occurrence on very steep to moderately steep slopes, moderately high bedrock or rock exposure, deep, dark *Ah* horizons of sandy loam to loam texture, and high subsurface coarse fragments partly distinguish this plant community. It represents either less disturbed sites or a recovery stage from c4 and c5 and is derived from c47. There is a discussion of similar communities for *Elymus glaucus* in c47.

Interpretations:

Preservation Priority: medium by general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is high. Seedlings are present on all sites and moderately well-stocked (above average). Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak - Broom -Parkland) to which this plant community has been assigned:

- high average numbers of wildlife habitat and use records, high numbers of utilization detections, high numbers of bird species recorded
- browse and seeds for wildlife, dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all provided by broom
- highest numbers of tree wildlife habitat features, some medium and large diameter oaks with high numbers of bark crevices, high numbers of small and medium and scaling dead limbs, bark glean, foliage glean, perching nesting, large dead limbs, crevices and cavities, snags, logs and decaying

logs, loose bark, hollow logs or tree hollows

Some stands have the following physiognomic type characteristics (Shrub oak- Basin-Broomland):

- potential habitat for chaparral bird species
- increased in food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- rich soil resources (earthworms), nectar

Grass species such as *Elymus glaucus* (blue wildrye) are rated as moderately important in winter, spring and summer by Nyberg and Janz (1990) for Columbian black-tailed deer. There are also thermal bedding and foraging opportunities on gentle to moderate south and west facing slopes and bedrock or rock exposure. *Cytisus scoparius* (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important as I recorded many spring utilization records. The rockiness and exposure provide habitat for garter snakes, especially in moister basin and receiving site occurrences. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderate based on the

following:

- low to moderate by physiognomic type
- mostly low by oak diameter (size class)
- low to high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

The typically dense stands of *Cytisus scoparius* (introduced broom) reduce aesthetic appeal. There is some detriment from the awns and calluses of weedy grasses which lodge in hiker's socks and bother them. *Vicia sativa* (introduced common vetch), present in moderate to substantial amounts, adds appeal to this community with its later season flowering and interesting pods. This plant community is often near the top of hills which are the destination of hikers, birders and naturalists.

Susceptibility to Disturbance: moderate

Prescribed Fire: The potential and need for the use of prescribed fire is moderate. This potential is subject to site-specific conditions to avoid creating a dense sward of broom.

Threats: high

Restoration Potential: moderate Restoration Priority: high

Special Management:

Cytisus scoparius (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin. *Elymus glaucus* (blue wildrye) has been cultivated and could be used in restoration. Selections should be made from the Garry oak habitat. Consideration should be given to *Allium acuminatum*, a species with yellow (potentially vulnerable) status, which this community seems to provide habitat for. *Osmorhiza chilensis* (sweet cicely) is cultivated and used in native plant gardening.

c4 Oak - Broom - *Poa pratensis*

Ecosystem Description:

Frequency of Occurrence: 5 plots, moderately frequent locally

Distribution: From Plots: Saanich Peninsula: Water Tower Hill, Scafe Hill, Thetis Lk. Pk., Glendale Lands, Naden Hill From Notes: none

Plant Community Description: *Cytisus scoparius* (introduced broom) thrives on all sites as a low (B2) and a tall (B1) shrub, both with high cover, averaging class 4 to 5 for the former and class 3 for the latter.

Poa pratensis occupies most sites and averages class 4 in cover. *Elymus glaucus* (blue wildrye), *Vicia sativa* (introduced common vetch), and *Sanicula crassicaulis* (Pacific snakeroot) occur on all sites, and average class 2, 1, and 2, respectively.

The remaining species are present on most sites. *Eurhynchium oregonum* (moss) averages class 2 to 3 cover. *Symphoricarpos albus* (snowberry), *Dactylis glomerata* (introduced orchardgrass), *Galium aparine* (cleavers), and *Camassia leichtlinii* (great camas) average class 2. *Bromus carinatus* (California brome grass), *Bromus mollis* (introduced soft brome grass), *Montia perfoliata* (perfoliate-leaved miners lettuce), and *Stellaria media* (introduced chickweed) average cover class 1 to 2. *Veronica serpyllifolia* (thyme-leaved speedwell) and *Geranium molle* (introduced dovefoot geranium) average cover class 1.

Tree Canopy/ Landscape Expression: generally tall shrub (B1) layer canopy

Oak Characteristics: Diameters: mostly small; Regeneration: Regeneration is occurring on most sites for both saplings and seedlings. Stocking is moderate for both.

Physiognomic Type: usually Oak - Broom - Parkland (3) or Shrub Oak - Basin Broomland. Suggested Successional Status: Mature Disclimax from Mature Edaphic or Climatic Climax

Constant Cover Value: 0.71 Adjusted Motyka Comparison: 1.12 Oak- Broom- *Elymus glaucus* (c47); 0.78 Oak- Broom- *Dactylis glomerata* (c5); 0.64 Oak- *Poa pratensis* (c29a)

Elevation: low to high (3) Slope: primarily gentle (one is steep)

Aspect: various Surface Shape: various, concave (2)

Moisture Regime: about submesic (subxeric to mesic) Exposure: several (3) with

insolation exposure Bedrock Geology: various: granitic or gneiss (3), no data (1) Surface Substrate Features: some moderately high bedrock exposure (class 3) (2) Soil Classification: Orthic Sombric Brunisols Humus Classification: usually Orthi Rhizomulls Depth of Ah Horizon: usually > 20 cm to 30 cm Colour of Ah Horizon: dark and slightly brownish Depth to Bedrock: some 5 to 25 cm (3) Surface Soil Texture: sandy loam to silt loam, usually gravelly to very gravelly at depth (4). Percent Coarse Fragments: various

Discussion:

This plant community is partly distinguished by its deep, dark *Ah* horizons of sandy loam to silt loam texture, and its occurrence on gentle slopes on a variety of aspects. It is geographically restricted to the Saanich Peninsula and is derived from c29a, ultimately from c13, c14, c47, and c43.

There are not communities described for these species in the literature on oak woodlands. This is despite the wide invasion of *Cytisus scoparius*, for example of the oak prairies of western Washington (Kruckeberg, 1993; pers.obs.) *Cytisus scoparius* was among the *Alliance* species of the *Quercus-Bromus (carinatus) Alliance* of Roemer (1972). There is a discussion of *Poa pratensis* and *Vicia sativa* in c29a and *Bromus carinatus* in c43.

Interpretations:

Preservation Priority: very low by the general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is moderately high. Seedling stocking is above average: moderately-stocked. Otherwise normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak - Broom -Parkland) to which this plant community has been assigned:

- high average numbers of wildlife habitat and use records, high numbers of

utilization detections, moderately attractive fresh sprouts, high numbers of bird species recorded

- browse and seeds for wildlife, dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all provided by broom
- highest numbers of tree wildlife habitat features, some medium and large diameter oaks with high numbers of bark crevices, high numbers of small and medium and scaling dead limbs, bark glean, foliage glean, perching nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows

Some stands have the following physiognomic type characteristics (Shrub oak- Basin-Broomland):

- potential habitat for chaparral bird species
- increased in food for foliage gleaners due to relatively more insect outbreaks
- dense, low cover for hiding and security in shrub oak
- rich soil resources (earthworms), nectar

There are also thermal bedding and foraging opportunities on gentle to moderate south and west facing slopes and some bedrock exposure. *Cytisus scoparius* (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important as I recorded many spring utilization records. *Symphoricarpos albus* (snowberry) is rated at low importance as winter forage, but seems to be higher, based on several spring utilization records. *Sanicula crassicaulis* (Pacific snakeroot) provides fresh sprouts for Coast deer and other grazing animals. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas

formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. Due to increased insect outbreaks, the shrub oak occurrences should furnish particularly good conditions for foliage gleaners such as orange crowned warbler (*Vermivora celata*), the second most frequent bird species in my 1993 sampling; and yellow rumped warbler (*Dendroica coronata*), the twelfth most frequent.

Symphoricarpos albus (snowberry) is one of the noted nectar producers for Rufous-sided and Anna's hummingbird, and probably for butterflies. Snowberry is the larval food of the snowberry bee hawk moth (*Hemaris diffinis*). *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderate based on the following:

- low by physiognomic type
- mostly low by oak diameter (size class)
- low to high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

The typically dense stands of *Cytisus scoparius* (introduced broom) reduce aesthetic appeal. *Symphoricarpos albus* (snowberry), present in moderate to substantial amounts, adds aesthetic appeal with its delicate leafing-out in spring, flowering and showy white berries persisting into winter. *Camassia leichtlinii* (great camas), present in moderate amounts, gives early season appeal with its flowering and interest value with its seed heads. Camas has cultural heritage value for its historic aboriginal use. *Montia perfoliata* (perfoliate-leaved miners lettuce) and *Stellaria media* (introduced chickweed) are edible, and could be eaten for enjoyment on unpolluted sites.

Susceptibility to Disturbance: low

Prescribed Fire: The potential and need for the use of prescribed fire is low and not advisable, except for trial sites with specific conditions.

Threats: high to very high

Restoration Potential: low

Restoration Priority: moderately high

Special Management:

Cytisus scoparius (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin. *Elymus glaucus* (blue wildrye), present in moderate quantities, is important to the recovery of this community. The species has been cultivated, but seed from Garry oak habitat selections should be used in any restoration. Consideration should be given to *Triteleia hyacinthina*, a plant species with yellow (potentially vulnerable) status, which this community seems to provide habitat for.

c5 Oak - Broom - *Dactylis glomerata*

Ecosystem Description:

Frequency of Occurrence: frequent, 5 plots

Distribution: From Plots: Gabriola Is.; Pender Island: Oak Bluffs; Saanich Peninsula: Thetis Lk. Pk.; western shore: Lester Pearson College From Notes: Saanich Peninsula: Summit Pk; western shore: Belmont Pk., Mary Hill.

Plant Community Description: *Cytisus scoparius* (introduced broom) occupies all sites as a low shrub (B2) and as a tall shrub (B1), both with an average class 3 cover. *Dactylis glomerata* (introduced orchardgrass) thrives, with high cover- class 4 to 5, on all sites.

Galium aparine (cleavers) and *Osmorhiza chilensis* (sweet cicely) occur on all sites and average class 2 to 3 cover. *Bromus carinatus* (California brome grass), *Poa pratensis* (introduced Kentucky bluegrass), *Vicia sativa* (introduced common vetch), and *Sanicula crassicaulis* (Pacific snakeroot) grow on all sites and average class 2 in cover.

The remaining species exist on most sites. *Vicia hirsuta* (introduced hairy vetch) averages cover class 2 to 3. *Montia perfoliata* (perfoliate-leaved miners lettuce)

and *Plantago lanceolata* (introduced narrow leaved plantain) average class 1 to 2. *Nemophila parviflora* (grove lover) and *Polystichum munitum* (swordfern) average class 1.

Tree Canopy/ Landscape Expression: usually high cover tree canopy (A) layer

Oak Characteristics: Diameters: various: 18 to 82.7 cm;

Regeneration: is present on most sites for both saplings and seedlings. Saplings are moderately well-stocked. Seedlings are lightly-stocked.

Physiognomic Type: Oak - Broom - Parkland.

Suggested Successional Status: Mature Disclimax primarily from Mature Climatic Climax

Constant Cover Value: 0.64 Adjusted Motyka Comparison: 1.07 Oak- *Dactylis glomerata*: Typic subcommunity (c28a); 0.78 Oak- Broom- *Poa pratensis*; 0.37 Oak- Broom- *Elymus glaucus* (c6).

Elevation: various, 30 to 120 m Slope: chiefly gentle, one steep

Aspect: east (110 deg.) to southwest (200 deg.)

Surface Shape: usually straight Moisture Regime: mesic to submesic

Exposure: wind (3) Bedrock Geology: various, several coarse: sandstone, conglomerate (3) Surface Substrate Features: few features

Soil Classification: usually Orthic Sombric Brunisols

Humus Classification: commonly Vermimulls Depth of Ah Horizon: usually > 25 cm(4) Colour of Ah Horizon: dark, 10YR 2/1, 2/1.5

Depth to Bedrock: typically without, two are shallow, 4 to 25 cm

Surface Soil Texture: tends to be coarse, all are gravelly or very gravelly

Percent Coarse Fragments: medium to high coarse fragments in the subsurface horizons (55 to 80 %)

Discussion:

Coarse-textured, deep, dark *Ah* horizons, medium to high subsurface coarse fragments, occurrence on gentle slopes and widespread geographic distribution partly

distinguish this plant community. It is derived primarily from c28a, partly from c30, and ultimately from three plant communities: c47, c41, and c43.

There is a discussion of *Dactylis glomerata* in c28a. It has been suggested that the nitrogen fixing ability of *Cytisus scoparius* is advantageous to the growth of *Dactylis glomerata*, strengthening its persistence in this type (Ceska, 1992, pers.comm.). This might be so, as its cover is slightly higher in this community than in c28a.

Interpretations:

Preservation Priority: very low by the general ranking. However, there is an elevated need to preserve deep soil parkland types such as this community.

Regeneration: Regeneration potential is moderate. Current regeneration is normal.

Wildlife Habitat and Use: The following are the most frequent characteristics of physiognomic type (Oak - Broom -Parkland) to which this plant community has been assigned:

- high average numbers of wildlife habitat and use records, high numbers of utilization detections, moderately attractive fresh sprouts, high numbers of bird species recorded
- browse and seeds for wildlife, dense security cover, singing and sallying perches, especially the B1 layer (> 2.0 m) individuals; all provided by broom
- highest numbers of tree wildlife habitat features, some trees and stands with large diameter oaks having high numbers of bark crevices, high numbers of small and medium and scaling dead limbs, bark glean, foliage glean, perching nesting, large dead limbs, crevices and cavities, snags, logs and decaying logs, loose bark, hollow logs or tree hollows

Rich soil resources, such as earthworms, are provided by this community. There are also thermal bedding and foraging opportunities on gentle to steep south and west facing slopes. *Cytisus scoparius* (introduced broom) is not rated as a winter forage for Coast deer, but appears to be important as I recorded many spring utilization

records. *Sanicula crassicaulis* (Pacific snakeroot) provides fresh sprouts for Coast deer and other grazing animals. Trees or stands of large diameter and high numbers of tree cavities provide habitat for cavity users such as chestnut backed chickadees (*Parus rufescens*), the sixth most frequent bird in my 1993 sampling; common flicker (*Colaptes auratus*), the seventh; Bewick's wren (*Thyromanes bewickii*), the ninth; house wren (*Troglodytes aedon*), the 13th; the blue-listed screech owl (*Otus kennicottii*); violet-green swallow (*Tachycineta thalassina*); big brown bat (*Eptesiscus fuscus*) and California myotis (*Myotis californicus*). These areas formerly supported western bluebirds (*Sialia mexicana*) and the blue-listed Lewis' woodpecker (*Melanerpes lewis*) and may still provide the cavities and other resources for possible reintroductions. *Bromus carinatus* (California brome grass) may be the larval food of common branded skipper (*Hesperia comma*), which feeds on *Bromus*.

Aesthetic / Recreational: Overall aesthetic appeal is rated as moderate to moderately high, based on the following:

- low by physiognomic type
- low to high by oak diameter (size class)
- high by form-class within physiognomic type
- moderately high by oak form-complexity within physiognomic type

The typically dense stands of *Cytisus scoparius* (introduced broom) reduce aesthetic appeal. *Galium aparine* (cleavers) has cultural heritage value for its historic aboriginal technological use. *Montia perfoliata* (perfoliate-leaved miners lettuce) is edible, and could be eaten for enjoyment on unpolluted sites. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) are present in moderate to substantial amounts, providing some aesthetic value with their flowering and interest value with their pods.

Susceptibility to Disturbance: low

Prescribed Fire: The potential and need for the use of prescribed fire is low and not advisable, except for trial sites with specific conditions.

Threats: very high

Restoration Potential: low Restoration Priority: moderately high

Special Management:

Cytisus scoparius (introduced broom) should be eliminated or controlled to the greatest extent possible and this plant community converted towards its native origin. *Bromus carinatus* (California brome grass), present in moderate quantities, is important to the recovery of this community. This species has been cultivated, but seed from Garry oak habitat selections should be used in any restoration. *Osmorhiza chilensis* (sweet cicely) is cultivated and used in native plant gardening. *Vicia sativa* (introduced common vetch) and *Vicia hirsuta* (introduced hairy vetch) are present in moderate to substantial amounts, and have the ability to fix atmospheric nitrogen. This ability could be put to use on certain sites where maintenance, not recovery, is the objective, or as a transitional measure for rehabilitative restoration.

CHAPTER 7 MANAGEMENT STRATEGY

7.0 INTRODUCTION

This chapter presents a management strategy for the Garry oak habitat, one which relates to the ecological information in Chapters 1 to 3, plant communities (Chapters 4 to 6), their interpretation (Chapters 5 and 6), and the background information for the study (Chapter 2). This is my subjective strategy which applies to both the Garry oak stands, which are the focus of the thesis, and the associated Garry oak meadows. There are deeper societal problems underlying the demise of the Garry oak habitat which are beyond the scope of my project. Unregulated growth has been rampant with the lack of government leadership and an enduring land ethic. These deeper problems should be given the highest level of consideration in government policy.

Land-use planning has not been adequate for meeting objectives for the Garry oak habitats (Erickson, 1994d). They are consistently compromised in the option-by-option planning scenarios, and decisions are still made almost solely on short-term economic grounds. The consequence of this history is the reduction of the Garry oak habitat to less than 1/10 of its former extent. The demise of these ecosystems (Erickson, 1994d) has combined with the ecological survey results to preoccupy the development of a management strategy which is intended to:

- preserve all larger Garry oak areas, acquiring those in private ownership
- apply detailed classification and inventory, preserve and acquire smaller parcels on a ecosystem-by-ecosystem (plant community-by-plant community) basis
- evaluate and actively manage each Garry oak parcel
- promote and undertake the research required to complement the activities of the strategy
- complete a variety of other activities

The strategy will have the most positive results if all its elements are implemented. Some components stand alone, others are contingent or complementary. The sections

are organized by relative importance, as are subsections within them. Preservation is addressed first, followed by management and the other aspects of the strategy. The final part deals with recommendations for agencies and the public to carry out the management strategy. When I use terms such as "would" and "will" throughout this text, the qualifier "if the strategy is implemented" is implied.

7.1 PRESERVATION OF GARRY OAK ECOSYSTEMS (see 2.7)

Garry oak ecosystems should be preserved to the maximum extent possible. Preservation is the most important component of the management strategy and would be the first option considered in land-use decisions. As Salwasser (1993) asserted, a network of representative native biological communities must be maintained across the landscape if biodiversity is to be conserved. Of these, any communities which are rare or imperiled in the region or nation are especially important (*op.cit.*). This qualification readily applies to the Garry oak ecosystems, which have been designated as critically imperiled in British Columbia (British Columbia Conservation Data Centre, 1992). Assigning a preservation designation is the most direct way to ensure that they are not lost as functioning entities, and that their endangered status is properly confronted. This will alleviate the public anxiety over the loss of this habitat (e.g. British Columbia Ministry of Environment, Lands and Parks, 1993). Preserving the habitat will be an ecological bellweather for the future of British Columbia ecosystems (e.g. Rowe, 1990). Scientific and management options will be ensured, along with the opportunity for the public to develop a full sense of value for the Garry oak ecosystems. Preservation will stop habitat fragmentation, ensuring retention of important biodiversity and habitat for threatened species.

Ideally, all remaining habitat portions would be preserved. Preservation efforts should no longer be confined to only the most pristine sites, nor limited to old standards like three representative sites per ecosystem. These standards are inadequate for the future of the last scattered Garry oak ecosystems. The same general impetus is already in place in British Columbia with the province's protected areas strategy (British Columbia Commission on Resources and Environment, 1994).

However the protected areas strategy is applied at a broader scale and its preservation objective of 12% (British Columbia Ministry of Forests, 1995) provides urgency only, for substantially less remains. It is particularly important to include all the remaining whole landscapes (e.g. whole hillsides), with as large an area as possible in each parcel. As Grambine (1990) has pointed out, an integrated system of large nature reserves is needed if biodiversity is to be protected. This will minimize habitat fragmentation (Roberts, 1987). Islands with oak landscapes are another high priority for preservation.

Implementation of the preservation strategy would be in a series of stages yet to be developed. For smaller parcels, minimum size criteria will have to be established. I suggest a very small minimum size that relates to the canopy zone of individual oaks. After all, "a single oak is a teeming, dynamic assemblage of multiple organisms: a city within a city; a micro-universe; a community so complex that we still do not fully understand the significance of all these interactions" (Russo, 1990, p.71). This scale will require a detailed inventory program. An ecosystem-by-ecosystem (applied to "plant community-by-plant community") process will be required in order to set priorities and evaluate progress within the preservation objective. Chapters 5 and 6 provide criteria and some guidance for this process.

Most of the Garry oak habitat occurs on private land. Under the strategy, there would be no further privatization of public land or loss to public projects such as highway developments. A major land acquisition fund is needed to procure the private lands in Garry oak habitat.

Direct participation of a local group to support each protected area is recommended. I suggest that community or neighbourhood associations be the focus for participation, with some role, perhaps representation, for oak interest groups. The limitations of government staffing strengthens the need for this measure. There is also a need to for the participation of these groups in managing and monitoring preserved areas.

The development and use of Oak Protection Plans for each local area is suggested as one major means of achieving the preservation objectives. These plans

are described in the section on local and regional governments in 7.4.

Preservation Status

Under the strategy preservation status would be assigned to public lands in the Garry oak habitat. These lands would be secured for preservation and kept out of the bank of undifferentiated public lands, which are treated as expendable. A small area of Garry oak habitat is contained in parks and ecological reserves, but often this is being used for objectives in conflict with preservation (e.g. Ceska, 1993). These uses can be extreme, such as playgrounds or landscaping encroachment, or more subtle, such as trampling by hikers. Guidelines for acceptable activities need to be established and a means found to communicate them to agency staff and the public.

Habitat Fund

A fund should be established for acquisition and management of the Garry oak habitat. The fund would be started with an amount equivalent to past habitat losses based on the concept of full ecological replacement costs. A schedule of these costs would have to be developed and standardized. If habitat losses are to continue, submission of costs would be required of the developer or agency to the habitat fund, as a supplement to working capital. Government might also consider mandating a wider scope that covers other critically imperiled habitats. This fund would operate at a much higher funding level and intense focus than the British Columbia Habitat Conservation Fund, which is concerned with habitat restoration, enhancement and acquisition on all of the habitats of the province (British Columbia Habitat Conservation Fund, n.d.).

Connections

Under the strategy, preserved Garry oak areas would be connected through a system of greenways, linear parks or other protected areas, where possible (Oberbauer, 1991). This concept is consistent with the use of "forested ecosystem networks" for achieving the biodiversity objectives of the Forest Practices Code

(British Columbia Ministry of Forests, 1995). Ideally the linkage areas would be other Garry oak areas with preserved status, but lesser status areas or other habitats, such as coastal grassland, Douglas-fir or pastures will also serve the desired function. Making these connections will help reduce the negative effects of habitat fragmentation (Roberts, 1987) and maintain ecological integrity. This will avoid the California experience of protected oak stands gradually becoming isolated islands in the midst of development (Ewing, 1990). My term "connections" corresponds directly to landscape linkages and corridors (Salwasser, 1993).

Buffers

Preserved Garry oak areas should be buffered where possible against outside influences (e.g. Oberbauer, 1991; Nernberg, 1994). Buffers serve also to protect surrounding urban areas from management practices in the Garry oak areas. Other natural ecosystems would be best for the buffers, but converted areas such as pastures will also suffice. In prairie restoration, native vegetation is reestablished on pasture buffers and they are used to connect habitat fragments (Nernberg, 1994).

Preservation Priorities

If all Garry oak areas cannot be preserved it will be necessary to set and apply priorities for selecting areas to preserve. There are sections in Chapters 5 and 6 designed to assist this evaluation on an ecosystem-by-ecosystem basis through assessments of preservation priority, threats, susceptibility to disturbance, aesthetic/recreational appeal, wildlife habitat and use. This orientation is appropriate to the recent focus on community biodiversity in conservation biology (Lertzman, 1993). As previously noted, it is imperative that any remaining whole landscapes also be preserved. Breaking up any more of these landscapes for development would definitely not be an option.

Detailed Inventory

A detailed inventory would be conducted for the Garry oak habitat using the

classification in this thesis. Salwasser (1993) stresses the importance of inventory as part of the process of conserving biodiversity. Although a generalized inventory has recently been completed, successful preservation requires an ecosystem-by-ecosystem assessment. Only then can representation of all communities be assured, consistent with the preservation of community diversity (Lertzman, 1993). We need to calculate the total Garry oak habitat area accurately for status assessments and to benefit from the exchange of information with other jurisdictions such as the Integrated Hardwood Range Management program of California (Schmidt, 1989), the efforts to preserve Engelmann oak (*Quercus engelmannii*) habitat (Scott, 1990) and the Carolinian Canada program from Ontario (Carolinian Canada, 1992). Additionally, a detailed inventory will provide information which accommodates the public's desire to preserve small parcels of Garry oak habitat in their neighbourhoods. Detailed mapping would be part of the inventory effort.

There is a particular lack of inventory information about bats and invertebrates, although there are many species of concern (Chatwin, 1993; Guppy, 1993). Some of these, such as several butterflies, may be the early warning indicators for the ecosystem. Rare plants need further inventory work.

With a detailed inventory, government can more adequately value the importance of each remaining piece of oak habitat. Actual field sampling efforts would be timed for the appropriate season of growth, characterized both in early-season and in later-spring conditions. The soil work of the detailed inventory can identify portions of the Garry oak habitat which would be recovered from Douglas-fir and shrub encroachment, based on the occurrence of its distinctive *Ah* horizon (see 2.4).

Application of Ecological Classification

In addition to the inventory effort, the ecological classification presented in this thesis would be applied to the Garry oak habitat under the strategy. It can aid in making decisions, such as selecting communities for preservation efforts. The classification will identify plant community diversity and therefore allow its

preservation in a way that a generalized classification rules out. It can organize current knowledge and be used to plan for future research; to extrapolate ecological knowledge from the U.S. part of the range; and to provide appropriate units for a detailed mapping effort. Applying the detailed classification is a pragmatic move, because it focuses on the variety of current plant communities, rather than hypothetical climax conditions (e.g. Nicholson et al., 1982) preoccupying sampling efforts in British Columbia (e.g. Klinka et al., 1979; Meidinger and Pojar, 1991). Operationalizing my classification can be a way to test its adequacy, provided that criteria are determined in advance.

Following this recommendation will allow the recognition of Garry oak ecosystems which has previously been lacking from the biogeoclimatic zones/subzones of the B.C. Ministry of Forests and the ecosections/ecoregions of the federal government (e.g. Ecoregions Working Group, 1989; Meidinger and Pojar, 1991). The lack of an appropriate classification has inhibited preservation by focusing the search for potential protected areas and national park representation on Douglas-fir, rather than on Garry oak communities (e.g. Vold, 1992). This level of focus contrasts with that given to the Carolinian biotic zone of southern Ontario, which has received inequitably greater attention (e.g. Carolinian Canada, 1992).

Classification for Garry oak Meadows

A detailed classification should be developed for the meadow portion of the Garry oak landscape. The classification presented in this thesis applies only to the stands and savannah areas with oaks. A parallel process of evaluation for the meadows requires detailed study and classification. Greater scrutiny may confirm the likelihood that the meadows are even more threatened than the stands (e.g. Pojar, 1980b; Ceska, 1982). A study of the meadows is also needed in order to clarify their status in relation to planting programs for Garry oak.

Private Land Program

A government program should promote private land preservation and

conservation (e.g. Johnson, n.d.; Huntsinger and Standiford, 1990; Sheehan, 1990; Durance, 1992). Most Garry oak is in private hands and there is a need for private land preservation and conservation. Voluntary private land preservation may present risks compared with public control, but land prices are high because of development and acquiring parcels is an expensive undertaking. In addition, owners may wish to demonstrate their land stewardship capabilities. There has been a favourable response to some programs (e.g. Sheehan, 1990; Durance, 1992). Partnerships need to be explored with groups such as Nature Conservancy of Canada and ways found to share the best management information and hone individual pride in the land.

7.2 MANAGEMENT (see 2.5, 5.12)

The Garry oak habitat areas need to be actively managed. The major activities are prescribed burning, broom control and recovery of areas where Douglas-fir and shrubs have encroached. Recommendations are given on an ecosystem-by-ecosystem basis in Chapters 5 and 6. Each Garry oak area would be assessed on-site for management needs and operations conducted according to an approved plan.

Prescribed Burning (see 2.5, 5.12, 5.13)

Prescribed burning is the most important treatment simulating natural maintenance regimes. Historically Garry oak ecosystems were adapted to frequent understory fires (see 2.5, 5.12 and 5.13). Fire control and elimination of burning practises have combined with other factors to lead to shrub and Douglas-fir encroachment, and probably other ecosystem changes. For example, Sugihara and Reed (1987) found that prescribed burning promoted forbs at the expense of grasses. A prescribed burn plan would be required for each fire. In addition to maintenance objectives (e.g. Sugihara and Reed, 1987), the practise is dedicated to the purpose of re-establishing the natural vegetation order (as discussed in 5.12) by stopping encroachment by shrubs and Douglas-fir and converting composition to oak-herbaceous types. I have identified this need for conversion in the plant community accounts. Long-term enclosure studies in blue oak (*Quercus douglasii*) habitat support

this premise by showing that after 50 years woody vegetation dominates the protected site compared with the maintenance of an open, park-like setting on the site which has been grazed and burned (Duncan et al., 1987). Conflict with oak regeneration and measures needed to prevent mortality will be addressed by these plans. A protocol on plan content will have to be developed to address many of these issues, along with conflicts with fauna such as butterflies. Particular attention would be paid to species with threatened status.

The proximity and infringement of housing into Garry oak habitat presents an unfortunate constraint on plans to re-establish the role of fire. As Oberbauer (1987, p.253) stated on the fire management issue, "the use of open space easements may be an inappropriate approach to mitigate impacts to (oak) woodland vegetation in a development that should not be approved in the first place." Current stand structure and composition are also issues. Thinning or girdling (Sugihara and Reed, 1987) might be required in combined treatments. Burning is also discouraged in dense stands of broom, as their seed bank is both prolific and stimulated to germinate by fire (Zielke et al., 1992).

This strategy recommends against any new developments within the Garry oak areas. However, if new developments are to be approved, the need for prescribed burning, both within and adjacent to the Garry oak areas, would be a basic consideration. A plan would be mandatory which accommodates burn containment in the buffering and configuration of housing layout, and outlines other appropriate measures.

Broom Control

Broom (*Cytisus scoparius*) should be controlled to the maximum possible extent (e.g. Zielke et al., 1982). This invader has usurped a wide range of Garry oak communities (the second-order disturbance communities in the previous chapter) and threatens the remaining ones (pers.obs.). Hand-pulling and clipping are control measures for the short-term at least. Broom should be added to the provincial noxious weed list to clarify public policy and intensify potential control action.

Further investigation should be made into other means of control, such as prescribed fire and the use of sheep grazing treatments in late-season (Zielke et al.). In the long term, biological control is needed to offset broom's competitive ability (e.g. Zielke et al., 1992). Biocontrol agents should be found and released, in order to control the species in a way which management action could not duplicate.

The extent, effectiveness and potential of volunteer efforts in broom control need to be evaluated. Quite a number of broom pulling and clipping treatments have been carried out by volunteer groups. Their efforts should be commended, but we need to know if this is potentially a lasting, large-scale solution, or one with temporal and areal limitations.

Encroachment (see 2.5, 5.12, 5.13)

Activities are needed to recover Garry oak habitat areas from encroachment by Douglas-fir and shrubs. Extensive portions of the Garry oak habitat are almost lost to this encroachment and are in need of vegetation conversion. In addition to prescribed burning, selective removal, patch harvesting or girdling (Sugihara and Reed, 1987) of Douglas-fir will be required. Exemptions will be required from tree preservation bylaws where these are interpreted to prevent this practise. Oak Protection Plans may be the mechanism to overcome this drawback. Mixed forestry plantations will have to be managed in favour of oaks, a reversal of previous priorities. Douglas-fir could be selectively cut to favour Garry oak. When oak does have to be cut, this cutting can allow it to coppice, rather than killing the tree.

Monitoring

The treatments carried out in actively managing the Garry oak habitat should be monitored for their effectiveness and influence on other ecosystem elements (e.g. Danielsen and Halvorson, 1990; Nyberg and Taylor, 1995). Where possible, an untreated area would be maintained for comparison. The importance of monitoring has gained acceptance in ecological management (e.g. Habitat Monitoring Committee, 1990). These sites will also serve a baseline monitoring function. The

comparisons could clarify unresolved questions, such as the effects of the treatments on oak regeneration or of climate change on vegetation.

Regeneration (see 4.3)

Regeneration of Garry oak should be actively promoted, except in the identified meadow areas. Garry oak is the foundation of these ecosystems, a "keystone" species (Griggs, 1990). It is a serious impact when regeneration is prevented or inhibited. Regeneration success would be monitored under the strategy. Chapters 5 and 6 give information about regeneration potential in the different plant communities and those where particular attention is suggested. Practices need to be developed which promote in-situ regeneration in natural habitats (e.g. Johnson, n.d.). Garry oaks would also be permitted to regenerate in cultural settings by modifying landscaping customs to allow establishment and survival. The practise of underplanting exotic tree species would be terminated. An organized system of acorn collection, storage and propagation should be developed. It will be particularly important to have stock available in the periodic non-crop years (e.g. Stein, 1990). Assessments would take into account the likelihood that many of the oaks are functionally male (L. Reed, 1992, pers. comm.). These trees are still vital to the stands and would not be removed or discounted.

Garry oak would be separated by provenances for regeneration. Collected acorns need to be distinguished or separated by geographic and ecologic area of collection to ensure local genetic integrity, promote seedlings adapted to local conditions and retain important characteristics like potential disease or insect resistance. The geographic area categories in this thesis could be considered for one level in the provenances. Planning for regeneration of Garry oak would include the reality that about 10 % of seedlings will prove susceptible to oak-leaf phylloxeran (*Phylloxera glabra*) and will need to be replaced (Duncan, 1995, pers.comm).

The use of tree protection devices or other measures will be required in certain areas to prevent browsing by deer, introduced eastern cottontail rabbits (*Sylvilagus floridanus*), and domestic as well as feral livestock (e.g. McReary, 1990b).

Control or elimination of the populations of these browsers would be considered, as they are also having an undesirable effect on ecosystem development (Pojar, 1980b; pers.obs.).

Control Introduced Plant Species (see 2.5)

In addition to broom, other introduced plant species would be controlled to the maximum extent possible, with the objective of eradicating them. This includes ivy, daphne and blackberry on moister sites and a number of other dominant introduced grass and forb species from the rest of the Garry oak landscape. Other than casual removal, control of these species would be carried out within the context of a vegetation management plan. Manual removal in some key areas may serve cosmetic purposes, but for grasses and forbs more widespread control remains as a future challenge. This subject is worthy of a further investigation and management trials. A small project at Government House seeks vegetation management through *Dactylis glomerata* (orchardgrass) removal and the use of the herbicide glyphosate (Hebda, 1995b, pers.comm.), although widespread use of herbicides would likely jeopardize the public appeal of this strategy. Removing domestic grazing and reseeded with native cultivars (cultivars derived from native species) would be two important components of the successful conversion back to native plant communities (e.g. Pojar 1980b; Holmes, 1990).

Insect Pests

Biocontrol agents should be found and released in the Garry oak habitat for the oak-leaf phylloxeran (*Phylloxera glabra*). Together with the jumping gall-wasp (*Neuroterus saltatorius*), this introduced insect pest poses a considerable peril to the tree and its ecosystems (Bennett, 1993; see 2.7). The oak leaf phylloxeran attacks about 10% of the trees, which may succumb in about 15 years when scorching is severe and persists annually (Duncan, 1995, pers.comm.). Removal of Garry oak would still be discouraged and a proper diagnosis made before any action taken. A wait and see stance is more appropriate for the jumping gall wasp, which attacks

most or all oaks, but seems to be coming under control naturally. There is also an additional stress from two other introduced insects, winter moths (*Operophtera brumata*) and *Pandemus cerasana* (Stein, 1990).

However, it is unlikely that Garry oak can carry the burden of another serious introduced pest, so vigilance will be required against the gypsy moth (*Porthesia dispar*), with monitoring and immediate control for any detections. Oaks are a preferred food for gypsy moths, so safeguarding the tree and its ecosystem will have to be paramount. This part of the strategy would also involve the existing inter-municipal strategy group (Duncan, 1993) which has focused on the first two insect pests.

Research Information

Although more research information is required for understanding the dynamics of the Garry oak landscape, there is a need to take a pragmatic approach and apply what we already have on hand or can conclude. Overly-cautious science can work against this effort. To wait for the 'proven' facts from probability sampling would increase the at-risk position of the ecosystems. Instead a philosophy of adaptive management should be adopted (e.g. Salwasser, 1993). Observations of naturalist stewards from an organized program could help to fill in the gap between management needs and the limitations of research information.

Restoration

This strategy urges caution in the emphasis placed on restoration relative to the other activities. Some of the previous suggestions for active management can be classed as restoration, yet it can also mean attempting to rehabilitate an area with only subsoil remaining. For this reason, restoration is promoted by the strategy, but only as a secondary component. To focus on restoration may serve to supplant more important activities with endeavours like native plant gardens. Rehabilitative restoration would be done under a restoration plan and consist of the most complete replacement of the ecosystem which is possible. This will obviously extend well

beyond simply planting a few seedlings and spreading non-indigenous "wildflower" seeds. A core feature will be the replacement of adult oaks and the moving of sods. This is because restoration means rebuilding a community which includes the natural diversity of plants and animals of an oak woodland (Griggs, 1990). Such a rebuilding must start with the basic components: the tree, the soil, the seed bank, the perennial plants. The program will be contingent upon trees and seeds being available, displaced from other development sites, or when a native plant materials program is in place. I have moved sods successfully and sods were the subject of the "meadow-move" by Swan Lake Nature Sanctuary. Adult domestic trees are routinely moved in landscaping and adult oaks have been moved in the California experience (Pavlik et al., 1992). These measures are the initial steps toward full replacement. They will allow the assignment of appropriate charges toward the cost of development, that begin to reflect the ecological losses.

The rehabilitative form of restoration would be secondary to more broadly applied active management, such as prescribed burning, which follow from the other elements of this strategy. There are important areas currently dominated by introduced species which would be converted back to native species. The animal and insect components would be considered and included in the efforts (e.g. Griggs, 1990).

Native Plant Materials

Native plant materials are needed for the active management and restoration objectives of this strategy (e.g. Nernberg, 1994). Selections should be taken from the Garry oak habitat. Garry oak tops the list of species needed. Recommendations for other key species are given in chapter 5 and 6. Generally, starting the program with the dominant (named) species of the plant communities is suggested. For example, seedlings of blue wild rye (*Elymus glaucus*) and California brome grass (*Bromus carinatus*) have been planted as part of restoration efforts in California (Danielsen and Halvorson, 1990). There should be a government-sponsored, organized system for collection, propagation and use for native plant materials (e.g. United States

Department of Agriculture, 1979). Such a system would also meet the broader demand arising from the biodiversity objectives of the Forest Practices Code (British Columbia Ministry of Forests, 1995). Using native plant materials for seeding should minimize disturbance by avoiding further introductions of non-indigenous species. This is consistent with the emphasis on native species for biodiversity objectives in British Columbia (op.cit).

It is suggested also that this program include a component of longer term genetic conservation. Establishing and maintaining the species in botanical gardens will serve this aim (Heywood, 1992). The genetic resources of the Garry oak communities could also be conserved through collection and preservation with extended cold storage of collected seeds (Blixt, 1992) and with cryotechnology. These methods should give a small insurance against absolute extinction.

7.3 OTHER ASPECTS

Liason with Public Groups

A viable forum would be established for liason with local public concern groups under the strategy. The success of the preservation program will depend on public support. Good communication with the local groups will be a first step toward more general public support. Active management of each Garry oak area will probably require the direct participation of a local support group. A workshop forum is suggested, focusing on issues raised by the participants. Having a designated liason staff person is necessary to these efforts.

Communication of Values

A program would be developed to communicate the values of the Garry oak habitat (e.g. Giusti et al., 1991; Mayolo, 1991; British Columbia Ministry of Environment, Lands and Parks, 1993). There are still members of the public and institutions who consider the tree a nuisance, and dump their landscaping refuse into oak habitat. A program of preservation and conservation requires the support of an informed public, institutions and their staff. Such a program may include

demonstration native gardens or seedling planting programs, but these would be only a minor part of overall efforts and funding. These activities can too easily divert resources from more important endeavours and diminish the preservation aims.

There is a need for extending information from U.S. oak studies and management experience (e.g. Plumb, 1980; Plumb and Pillsbury, 1987; Standiford, 1991). Washington State, for example, seems to be at least fifteen years ahead of British Columbia in identifying and managing these areas (e.g. Sheehan, 1990; Schuller, 1993). The detailed classification can be used to link our plant communities with their analogues from the U.S. range to anticipate succession, management potential and constraints.

Research Strategy

A research strategy would be developed for the Garry oak habitat, making the most of the few studies available, providing a logical linkage between the myriad of potential topics and priorities of need. Research serving a purpose for preservation and conservation is highest priority. An evaluation report would be prepared as a starting point for the research strategy. The report would highlight past and present research, organize this information and make it available for the public and resource managers.

Scientific Studies

Although a pragmatic approach is suggested to the adoption of practices needing study (adaptive management), there is still a strong need for salient scientific studies. These studies would be directed toward preservation and conservation and cover a wide range of ecological topics.

Bats and invertebrates of the Garry oak habitat are particularly in need of study (e.g. Chatwin, 1993; Guppy, 1993; British Columbia Ministry of Environment, Lands and Parks, 1994). Essential studies are needed for the many threatened and endangered butterfly species and other invertebrates of the Garry oak meadows (op.cit.). The same can be said of archaeological and ethnobotanical resources, such

as the rock-lined earth ovens used for camas (Kavanaugh, 1988; Turner, N., 1995, pers.comm). Scientific attention would be given to the many bird species, such as Lewis' woodpecker, Cooper's hawk, western bluebird and band-tailed pigeon that rely on or may be lost from this habitat (see 2.7). The birds are important to the Garry oak habitat for the ecological role they play: a role which should be understood. Steller's jays may be another vital member of the ecosystem through their acorn-caching activity.

Flexibility for Climatic Change (see 2.7)

This strategy would remain flexible enough to adapt to the anticipated effects of climatic change (Benton, 1993). Simply identifying this potential need is one measure. Near an ecological tension zone, the Garry oak habitat and adjacent Douglas-fir would be particularly affected by a trend to global warming. The strategy should be designed to adapt to changes such as the predicted migrations of plant species. Douglas-fir is expected to give way (Benton, 1993) and Garry oak to maintain its limits on the drier climatic edges (e.g. McBride and Mossadegh, 1990). The Garry oak vegetation should be able to expand into the wetter climatic edges (Hebda, 1991, 1992). Monitoring the Garry oak plant communities is recommended as a way of detecting early warning signals and anticipating needed changes in management. If necessary, the area for the strategy could be extended or the treatments within the strategy modified to adjust to the changes.

7.4 CARRYING OUT THE MANAGEMENT STRATEGY

Grassroots Level

The public has much to offer. Most community groups have an interest in their local environment and would actively participate in a wide range of volunteer efforts. Community and interest groups can support this strategy on public land by helping to identify oak habitat areas and participating in their promotion, inventory and management. It is suggested that each protected area have volunteers to form one local support group. These volunteers can serve on local committees, contribute

advice and participate in management efforts, such as prescribed burning, broom pulling, control of Douglas-fir and introduced plant species, and in promoting regeneration of oaks (e.g. Danielsen and Halvorson, 1990). They can assist in monitoring management treatments and help in special projects such as the release of biocontrol agents. Motivated individuals can volunteer as naturalist observation stewards to supplement research initiatives. Although participation is important to the success of the strategy, ongoing coordination and program management needs to be ensured.

On private properties, landowners with natural oak habitats can choose to dedicate them for voluntary preservation through the use of a conservation covenant. It is suggested that these covenants be developed cooperatively with a local public support group, who can then monitor to ensure their status, and registered in favour of a higher level organization such as the Nature Trust of B.C. Owners of small parcels can participate by maintaining natural oak habitats or allowing cultural oak habitats to revert to a more natural state. Doing so will be a good contribution to water and resource conservation by avoiding the demands of cultural landscape vegetation. This backyard biodiversity approach could develop into a cultural norm, as members of the public share it with each other (e.g. Binder et al., 1994).

Landowners can set an example by showing tolerance for the burgeoning production of leaves, twigs and branches from oak, for its natural cycles of death and decay and the effects of the health challenges it currently faces from the outbreaks of introduced insect pests. Under the strategy, oaks defoliated by these insects would not be cut down, as they generally resume growth in the following year. Dead and dying limbs and individual oaks would be left as wildlife habitat. Pruning removes these and other ecological attributes. Mowing, watering and herbicides are not necessary and are detrimental to the tree and ecosystems (Litton, 1980; Johnson, n.d.; Swiecki, 1990).

Public Interest Groups and Committees

Regional and provincial public interest groups and quasi-governmental/public

committees can participate in promoting and sharing information about oak habitat, preservation, inventory and research. These groups may be represented in appropriate forums and workshops about policy and direction for Garry oak habitats.

Some of the groups will also have a more administrative role. Under the strategy, trust funds with a habitat acquisition mandate, such as the British Columbia Habitat Conservation Fund and the Nature Conservancy of Canada would come forward with the funds and negotiating skills to acquire key parcels of Garry oak habitat for the public lands preservation effort. Either a group such as the Nature Trust of British Columbia, the Habitat Conservation Fund or Wildlife Branch would administer a provincial level habitat acquisition and management fund for Garry oak ecosystems. Government might also consider mandating a wider scope that covers other critically imperiled habitats. These trusts or other organizations with expertise would work cooperatively with landowners on conservation covenants for the preservation of private land, and accept covenants in their favour. Organizations such as the Habitat Conservation Fund can play a greater role in promoting management treatments through their enhancement fund and in funding management oriented research for the Garry oak habitat.

Local and Regional Government

Oak Protection Plans (Ward, 1993) are the primary avenues for local and regional governments to contribute to the strategy. These plans will identify and map oak stands, the associated meadows, appropriate buffers and linkages; recommend public land areas for provincial preservation status; assign local or regional park status to public lands; recommend private land areas for purchase or dedication in the event of development proposals; and outline the use of conservation covenants, tree cutting bylaws, required setbacks and other means of achieving oak and habitat protection (e.g. Litton, 1980; Johnson, n.d.; Elmendorf, 1991; Greater Victoria Water District, n.d.). Considerations such as proximity to municipal water and sewage systems and transportation corridors may be built into these plans, as it is a detailed planning level.

Under the strategy, local and regional governments would maintain a summary of each lot with oaks for use in planning. A detailed vegetation inventory is to be a prerequisite of each development proposal (e.g. Elmendorf, 1991). This will include the use of the detailed classification and specified information about the oaks themselves. Local and regional officials would monitor to ensure compliance with this inventory requirement. A transfer of subdivision approving authority from Ministry of Transportation and Highways to Islands Trust should ensure that due consideration is given to the oak habitat before any approvals. On unorganized territory this transfer of authority would be to regional districts.

If development is to be considered for Garry oak habitat areas there needs to be meaningful planning. The Garry oak habitat has been consistently compromised when proposals are considered on an area-by-area basis (pers.obs.). In practice the options have been limited to total preservation with compensation vs. 95% development (pers.obs.). Planning should proceed with good information and the flexibility of options weighted in favour of retaining substantial portions of the habitat within development areas. Changes to the Municipal Act are needed in order to drastically increase the park dedication requirements and make these dedications necessary from strata-title developments. For oak habitat the minimum park dedication would be increased to perhaps 35%. Even this is a compromise, for much higher proportions, such as 65% or 75%, would be set-aside if preservation were to be balanced with development. Contiguous oak areas would be emphasized to maximize ecological interactions and guard against habitat fragmentation (as previous). Parks for recreation use, such as playgrounds, would be dedicated separately and located outside oak habitat. The scheduling of dedication needs to be improved, by requiring the park dedication lands "up front" with the original development proposal.

Local governments need to establish and enforce bylaws against dumping landscaping or other refuse in the Garry oak areas. Tree preservation bylaws which include Garry oak need to be developed for all areas and enforced. Similar measures need to be added to guarantee the natural recruitment of younger oaks to replace

the older generation when they die. Otherwise the California experience will be repeated, as young oaks are cut down just before they reach the height covered by the ordinance (bylaw) (Ewing, 1990). Under the strategy, access would be ensured to all public parcels in order to promote the values of the habitat. Parks staff would modify their landscaping practice to reverse encroachment of cultural landscaping into the Garry oak habitat, to maintain and to recover the habitat. The practise of underplanting exotic tree species would be stopped and these canopy zones recovered. Promoting Garry oak vegetation will save park expenditures for watering, mowing, materials and herbicides, providing additional benefits as well (e.g. Litton, 1980; Johnson, n.d.; Elmendorf, 1991; Greater Victoria Water District, n.d.). Bylaws which lead to the destruction of Garry oak habitat need to be repealed, such as those requiring lawn establishment and cutting (e.g. Greater Victoria Water District, n.d.).

Landscaping conventions would be changed to permit regeneration of Garry oak and the development of natural ecological cycles associated with oak litter. Natural cycles also result in snags, dead limbs and other features of old stands, which are some of the most important wildlife habitat attributes (Thomas, 1979). Alternatives to tree removal could be explored, in order to overcome the limitation posed by liability concerns for public safety. Parks staff can serve on local committees, contribute advice and participate in management efforts. These activities and the conventional landscaping practices to be avoided are described under the grassroots section.

Building envelopes for development would be minimized and designed around existing oaks, rather than imposed without regard for them (e.g. Litton, 1980; Johnson, n.d.; Elmendorf, 1991; Greater Victoria Water District, n.d.). The size of roads, parking lots and other service corridors would also be minimized. As many oaks as possible would be maintained and root zone protection should be ensured for all these. A radius of 1 1/2 time the outer canopy is suggested. Snow fencing erected during construction would safeguard these oaks. Meadow areas of native vegetation would be identified with a spring survey (early- and late-season) and retained. Covenants may be used to protect the native vegetation areas.

Local and regional governments currently lack the necessary staff and resources to participate fully in the strategy. They would be given an additional level of support and information upon which to form policy and practise. Their staff would be supported in efforts to act as stewards for the oaks. Higher levels of government could benefit from the resulting exchange of information. Local and regional governments would add ecological planners to their staff to carry out the many activities associated with planning, preserving and managing oak habitat.

First Nations Bands

First Nations Bands own existing Garry oak habitat and have the opportunity to support a continued future for the oak ecosystems. It is suggested that they review the strategy and adopt the appropriate measures from the various sections. The bands could contribute their unique perspective to a process of liason and maintenance for the Garry oak areas.

Greenways/ Provincial Capital Commission

The Provincial Capital Commission would contribute to Garry oak habitat preservation by ensuring natural vistas on the highway approaches to Victoria, thus promoting the aesthetic value of the habitat. Its Greenways committee can foster linkages of the Garry oak habitat areas with a variety of land-use designations and partnerships with private land owners. A guidebook would be developed and advanced for preservation and management of Garry oak on private lands. Popular presentations (e.g. videos, CD ROMs) should complement this effort. Greenways trail initiatives would strengthen the status of the Garry oak habitat, not diminish it as commuter cycle paths completed to highways standards would do.

Institutions: University of Victoria (UVIC), Camosun College, Wilkinson Road Jail, William Head Prison, B.C. Hydro, Hospitals, School Districts, Water Districts, BCBC, Airport, Observatory:

These public institutions need to recognize the habitat and its values. Logically

UVIC would be providing leadership, but so far it has been unable to take any progressive measures. For example, a small grove of Garry oak was recently cut down for a parking lot which could have easily been placed on adjacent cultural lands. UVIC has continued to allow landscaping to encroach at the expense of native plant communities and degrade the habitat into a dumping ground for landscaping refuse and soil storage. Oak Protection Plans for each of the areas would be primary means of participation by these institutions in the strategy. If development cannot be avoided, then the principles described for local and regional governments would be followed.

These institutions need to map and identify all portions of Garry oak habitat, including the associated meadows, assign them preservation status and plan any developments at a buffered distance away. Landscaping practices would be modified as described for the grassroots and local government levels, including the obvious remedy for the particular threats described above. There would be no clearing of areas adjacent to trails. Alternate ways of addressing safety concerns should be suggested, such as fencing or re-routing the trails.

Vegetation management plans would be developed and applied for Garry oak areas on these institutions. Under these plans, B.C. Hydro would allow Garry oak to develop to low tree height (often its maximum) on transmission lines. Douglas-fir could be selectively cut to favour Garry oak. When oak does have to be cut, this cutting can allow it to coppice.

Departments within UVIC could participate with the Research Sections of Wildlife Branch and Ministry of Forests in creating a research strategy and carrying out needed scientific studies. Many of these studies could involve the colleges and be management-oriented, allowing student participation in actively managing Garry oak habitat areas.

Wildlife Branch/ Ministry of Forests/ Conservation Data Centre/ Aboriginal Affairs

Research sections: Under the strategy, these sections would share information with the public about Garry oak ecosystems and promote the preservation and

conservation of the habitat at both higher and lower levels. Ministry of Aboriginal Affairs or the sections within the other ministries would establish and maintain liason with First Nations peoples on the values and maintenance of the Garry oak habitat. All the principles otherwise contained in the other sections would be considered. No doubt others will be established, given the unique perspectives of the native communities. Either Wildlife Branch or a group such as the Habitat Conservation Fund or the Nature Trust of British Columbia would administer the provincial level habitat acquisition and management fund for Garry oak ecosystems.

The first three organizations would maintain specialized expertise for these ecosystems. Conservation Data Centre can lead in status assessments and coordinate the information about each parcel. Detailed inventory would be initiated, led and coordinated by these three organizations. They would assist in operational level inventories, propose and promote specific areas for preservation. If all the Garry oak areas cannot be preserved these three sections would be responsible for setting and assigning priorities for preservation. It is recommended they start with the criteria and assessment in chapter 5 and 6. These three research sections would sponsor the sampling and development of a detailed classification for the Garry oak meadows and arbutus (*Arbutus menziesii*) ecosystems. They would promote application of the most appropriate research or management information: the approach known as adaptive management (Lertzman, 1993). These sections would develop a research strategy, promote and conduct needed scientific studies.

These three organizations would develop the template for a standard vegetation management plan to be used in assessments and management of Garry oak habitat. They would promote habitat restoration, but only as a secondary component of the strategy. A plant-materials-conservation centre should be developed for plant materials and genetic resources of the Garry oak habitat. The tree itself can simply be added to the existing nursery system with acorns taken from different geographic and ecological areas for provenance testing. Biocontrol agents should be investigated for broom and for the other problem species of the habitat.

These sections would establish a forum for liason with local public concern

groups. Specialists would serve on committees, contribute advice, and participate in implementing the vegetation management plans for each habitat area. This will involve the same activities described for the grassroots level. Consulting ecology assessments would be provided when requested by the municipal or regional district levels. A standard is required for these assessments for they will have to be based on original field information which provides a meaningful evaluation, not just a compilation of opinions and what is already known about an area. Proper timing of these assessments is a consideration. They should be taken in both early and late spring.

Operations/ Inventory sections: MOF, Wildlife Branch, Parks Branch:

Under the strategy, these organizations would conduct the detailed inventory on parcels already in their management jurisdiction, using the ecological classification in this thesis, identify and propose parcels for preservation (MOF, Wld.Br.) or accept transferred parcels and apply preservation status (Parks Branch), and develop a vegetation management plan for areas to be managed jointly for oak and other resources (MOF, Wld.Br.). These vegetation management plans will apply to plantations and encroached areas which otherwise would have been managed for Douglas-fir. These agencies would promote the addition of broom (*Cytisus scoparius*) to the provincial noxious weed list and the search for biological agents for its control. Under the strategy, there would be no further authorization and the withdrawal of any existing tenures for livestock grazing, because the conflicts with the values of the Garry oak habitat represent a basic incompatibility (pers.obs.; Holmes, 1990; Erickson, 1994c). Enforcement is needed against trespass grazing of domestic livestock. Feral sheep and goat populations would be removed. Arrangements would be made to put an end to domestic livestock grazing on private lands in the Garry oak habitat areas. No conservation covenants in these areas would permit domestic livestock.

Under the strategy Parks Branch would refrain from further diminishing Garry oak habitat with park developments, restore and rehabilitate damaged areas, such as

Ruckle Point. The work would be guided by a restoration plan if rehabilitative or a vegetation management plan if it is "active management". These organizations can represent and promote the Garry oak habitat program at a local level. Interpretations programs would be developed for the habitat, thereby instilling or reinforcing a sense of their value (e.g. Binder et al., 1994). It is suggested this work be done cooperatively with the Education Coordinator for Ministry of Environment, Ministry of Education and the relevant school districts.

Parks Branch has a special role to play in the preservation program for Garry oak habitat. They can provide the expertise for handling the negotiations and acquisition process for land parcels to be added to the program.

Ecological Reserves program

The strategy will result in many additions of suitable candidate areas to the ecological reserves program. The concept of active management needs to be reconciled with previous approaches for Garry oak areas with preserved status and those to be added to the system. Vegetation management plans are needed which simulate natural disturbance regimes and seek the recovery of native plant communities.

Ministry of Education and relevant School Districts

Under the strategy, Ministry of Education and the relevant school districts would work cooperatively with Parks Branch and the education coordinator for the provincial environment program to develop educational materials for interpreting Garry oak habitat (e.g. Mayolo, 1990; British Columbia Ministry of Environment, Lands and Parks, 1993; Greater Victoria Water District, n.d.; Binder et al., 1994). It is recommended that the program include hands-on involvement with planting oaks, maintaining and studying the habitat in the field (e.g. Nives et al., 1991; Keay, 1993).

Lands Branch

Lands Branch will ensure that there will be no further alienation or leasing

of Garry oak habitat. Carrying this out will require this agency to be involved in the detailed inventory program for each alienation request in the general Garry oak habitat areas.

Highways

Under the strategy, the highways program would identify and exclude Garry oak parcels from the general highway corridor areas, re-routing plans around them. Highways would negotiate to acquire private land portions, then turn these parcels over to the jurisdiction of other agencies to assign status and adopt management.

Highways would employ a true rehabilitative restoration program for Garry oak areas already denuded, such as the MacKenzie Interchange. This program would flow from a restoration plan acceptable to the main agencies and consist of the most complete replacement of the ecosystem possible. When the materials are not available, the agency would make a mandatory contribution to the habitat acquisition fund, based on full replacement costs.

Department of National Defence and Canadian Wildlife Service

Under the strategy, Department of National Defence and the Canadian Wildlife Service (DND/CWS) would cooperatively identify and assign preserved status to the Garry oak areas within their jurisdiction. They would carry out an inventory using the detailed classification, develop and implement both an oak protection plan and a vegetation management plan on each area. CWS would participate with the three provincial research sections in developing a research strategy and carrying out relevant scientific studies.

National Parks program

The national parks program needs to revise its national classification system to accommodate the Garry oak habitat as a biotic zone. This change in classification will allow its national significance to be recognized in a direct way. Application of the same criteria as the Carolinian of Ontario should result in the preservation of

one Garry oak landscape area (e.g. whole hillside or island) as a national park.

National Environment and Forestry programs

The federal environment program would revise its proposed endangered species legislation to include plants, communities and the habitat of endangered species. Program staff would encourage the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to establish national status of plant communities and to apply reasonable criteria. The program would coordinate the national status of the Garry oak ecosystems as a habitat of national significance. Comparisons would be made with the Carolinian biotic zone of Ontario and a national strategy suggested.

The program would continue monitoring for oak-leaf Phylloxera, jumping gall wasps and gypsy moths, providing public information on these pests and participating in appropriate committee work. They would find and release biocontrol agents for Phylloxera and take immediate control action against gypsy moth where it is detected. The program would promote the search and release of biocontrol agents for broom (*Cytisus scoparius*).

Political Level

The political level should address the higher level problems such as the lack of an enduring land ethic, unregulated growth, the lack of meaningful planning and decisions made almost solely on short-term economic grounds, all of which were beyond the scope of my project. The political level can develop policy statements which clarify the values held for Garry oak ecosystems and set the scene for the other levels. The concept of the Garry oak "heritage landscape" has already been used by the City of Victoria and could be extended for the municipal, regional, provincial and national levels. More specific would be a charter of rights for the Garry oak ecosystems. This symbolic gesture would recognize the right of these ecosystems to exist for their own sake. Legal enforcement of this right could be considered as an option.

The success of this management strategy is dependent on political acceptance. One provincial minister, such as Environment, would act as government leader for the program. Wildlife Branch would be the lead agency for the efforts on the Garry oak habitat. Adopting Garry oak ecosystems as a "flagship" habitat for the province would be beneficial. The federal minister could assist by bringing forward concern for the ecosystems, giving guidance to staff. Municipal and regional district politicians can support the provincial and federal programs and the recommendations in this strategy outlined previously for the local and regional governments.

CHAPTER 8 SUMMARY

A literature review on the vegetation and ecology of Garry oak ecosystems helped identify values, ecological perspectives and assumptions used in my study. This information is presented and interpreted as a background to the rest of this text. Other vegetation work from the literature provided a context for my plant community classification. The endangered status of the Garry oak ecosystems sharpened the need for a classification and associated recommendations.

A three-year reconnaissance ecological survey of the main range of Garry oak (*Quercus garryana*) ecosystems in British Columbia was completed using standard, subjective methods. Additional work in the U.S. part of the range helped provide a setting for the study. I used measures such as cover classes to increase efficiency and ensure the numerical adequacy of the sampling effort. Over 300 reconnaissance plot descriptions were used to form a plant community classification with 43 plant communities, organized as follows:

- 27 native plant communities, of which:

- 7 are early season

- 5 are of bedrock outcrops, and there are

- 15 others

- 9 first-order disturbance communities (introduced species, but without broom (*Cytisus scoparius*) dominance)

- 8 second-order disturbance communities (introduced species and broom dominance), of which:

- 3 are of bedrock outcrops, and there are

- 5 others

A key to the plant communities is provided, along with tabular and text descriptions. I did not adopt a taxonomic classification framework, instead just assigning the term "plant community" for the basic elements, with plant "subcommunity" added as necessary. This is the first time many of these communities have been recognized in British Columbia, although most have analogues further

south within the range of oak woodlands. Some particularly notable communities are from the early season category, usually dominated by camas (*Camassia quamash*, *Q. leichtlinii*) and those communities dominated by native grasses such as Idaho fescue (*Festuca idahoensis*) and blue wild-rye (*Elymus glaucus*). The classification differs from most previous work in British Columbia by concerning itself with the variety of actual plant communities, rather than only those hypothesized to represent a theoretical climax condition. A context is provided for my communities by incorporating a discussion of similar communities from the literature into the text description of each.

My classification was formed using subjective methods based on tabular comparison (Mueller-Dombois and Ellenberg, 1974), but emphasizing plant dominance through cover. This orientation is consistent with the Anglo-American approach to vegetation classification. Several objective tests were used, with the purpose of aiding the subjective classification. Success in adequately representing the cover of constant species within communities was checked with the use of a "constant cover value index". The degree of similarities and differences between communities was checked with the "adjusted Motyka coefficient". Several realignments of communities into subcommunities were made as a result of the coefficient values obtained. Both of the previous tests also served to reinforce the primacy of cover in my classification. Comparisons with community pairs from other oak woodlands, savannahs and grasslands within the Pacific Northwest produced a scientific context for my classification by comparing its level of differentiation with that of the other studies. My level of differentiation compared most closely with that of the other studies of oak woodlands. An automated classification, *TWINSPAN*, was considered as an objective test of classification, but it did not meet my review objectives and therefore did not contribute to the final classification.

Interpretations and descriptions are given for the ecosystems associated with the plant communities. The descriptions are derived from the plot work, with key features generalized and asserted subjectively. Ecological relationships for the plant communities are given in three ways: in charts of distribution and moisture regime;

in landscape diagrams; and, from a temporal perspective, in charts with suggested origins and derivations. Multiple regression and correlation results objectively suggest relationships at a broad level between the plant community gradient and environmental variables, particularly ecological moisture regime and elevation. Interpretations are given for categories such as preservation priority, wildlife habitat, aesthetic/recreational attributes and susceptibility to disturbance. These subjectively assigned characteristics, uses or values are intended to provide considerations or suggest actions in management decision-making. The final assessment is intended to be made within the context of the overall management strategy.

Climate summaries for the study years suggest that while climate was not normal, it seemed to vary around normal in such a way that it probably did not cause a change in vegetation for the study years. Oak regeneration results from my plots were generally favourable and lacked differences between native plant communities and introduced ones. This lack raises questions about hypotheses which consider competition from introduced species, broom and native shrubs to be suppressing oak regeneration.

The demise of the Garry oak ecosystems combined with the ecological survey results to preoccupy the development of a management strategy intended to:

- preserve all larger Garry oak areas, acquiring those in private ownership
- apply detailed classification and inventory, preserving and acquiring smaller tracts on an ecosystem-by-ecosystem basis
- evaluate and actively manage each Garry oak parcel
- promote and undertake the research required to complement the activities of the strategy.

This management strategy for the Garry oak habitat emphasizes its preservation and the need for active management. Carrying out the management strategy requires multiple-party involvement. The strategy and interpretations should help maintain and preserve ecosystem integrity and biodiversity.

In summary, this ecological study is probably both a contemplative and a hopeful one. The study is contemplative, as it could be the last detailed look at a diminishing ecosystem, but the study is hopeful, in that it may be one of the turning points in the recognition and recovery of a biologically unique and important heritage.

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APPENDIX 1 COMPARISON OF PREVIOUS VEGETATION WORK

Roemer (1972) presented several units¹ from the Saanich Peninsula which were relatively unique: the *Quercus-Geranium*, the *Quercus-Erythronium* and the *Quercus-Erythronium-Campanula*. Types with some similarities were noted for British Columbia, but they are without close analogs in the literature for oak woodlands. Szczawinski and Harrison (1973) described a type for the Saanich Peninsula in which *Erythronium oregonum* was a characteristic indicator. Pattison and Karanka (1981) mentioned the species in their key to the Garry Oak-bairy honeysuckle-California fescue² vegetation unit on Galiano, Valdes, and Cortes Islands. Janszen (1977; 1981) described a community for Saturna and Mayne Islands which included *Danthonia californica*, *Bromus sterilis*, *Trifolium microcephalum* and *Trifolium tridentatum*. *Camassia leichtlinii* was also present on Mayne Island.

Franklin and Dyrness (1973) mentioned that communities of the Puget Sound prairie were similar to those of Roemer (1972). The Vancouver Island stands showed the greatest similarity to non-oak areas; the Oregon "balds" (Aldrich, 1972) and the coastal prairie of California (Heady et al. 1977); both of which also featured a rich forb cover followed by native grasses.

Elymus glaucus, *Bromus carinatus* and *Poa pratensis* were shared between the *Elymus glaucus* provisional association of Aldrich (1972) and the *Quercus-Geranium* association of Roemer (1972). The *Lomatium martindalei* provisional association (Aldrich, 1972) had *Erythronium oregonum*, *Aira caryophyllea* and a *Festuca* species³ in common with the *Quercus-Erythronium-Montia* subassociation, *Lomatium* variant

¹ This comparison is between the communities of Roemer (1972) and those described in the remainder of the range. Due to the complexity of Roemer's classification, only those units discussed were compared. I felt they were representative though, and that the generalizations would hold, if a full comparison were applied.

² Pattison and Karanka's 'California fescue' could have been *Bromus carinatus* (California brome grass) or *Danthonia californica* (California oatgrass). There are no records of *Festuca californica* for B.C..

³ *Festuca idahoensis* ? (my question).

(Roemer, 1972).

The coastal prairie of California is the second non-oak type with similarities to the associations described by Roemer (1972). Communities dominated by *Festuca idahoensis*⁴ and *Danthonia californica* are related to the *Quercus-Erythronium-Montia* subassociation, *Lomatium* variant of Roemer. *Bromus carinatus*, featured in the naming of the *Quercus-Bromus* Alliance by Roemer, also dominates some of the coastal prairie sites in California (Heady et al., 1977).

Quercus garryana-Rhacomitrium-moss communities have been described for the Saanich Peninsula (Szcawinski and Harrison, 1973, = *R. canescens*); Galiano and smaller islands (Pattison and Karanka, 1981, = spp.); for the Mt. Tuam Ecological Reserve (Taylor and Brayshaw, 1978, = *heterostichum*); Saturna and Mayne Islands (Janszen, 1977; 1981), and for Gabriola Island (Oswald, 1977). Salstrom (1989) classified a *Pseudotsuga menziesii* / moss (*Rhacomitrium canescens*) woodland with *Q. garryana* on Pt. Disney, Waldron Island, Washington.

Two vegetation units from Galiano, Thetis, Kuper, and Valdes Islands have stunted Garry oak, with grasses dominating the herb layer (Pattison and Karanka, 1981). The Nootka rose-early hairgrass-rock outcrop unit is found adjacent to the ocean, while the Alaska brome-grass-*Rhacomitrium* moss-rock outcrop unit occurs at a distance. *Rosa nutkana*, *Aira praecox*, *Bromus sitchensis*⁵ and *Rhacomitrium* spp. are featured in the names of the units. *Aira praecox* was also characteristic of bare rock outcrops on Saturna and Mayne Islands (Janszen, 1977; 1981). *Bromus carinatus* does not combine with *Rhacomitrium* spp. on the Saanich Peninsula (Roemer, 1993, pers. comm.), although a broader California Brome understory type has been recognized in association with bedrock outcrops for the CDF biogeoclimatic zone (Nyberg and Janz, 1990). Stunted Garry oak were a rare occurrence in the Douglas-

⁴ Roemer's (1972) *Festuca* sp. has now been described as a new taxon, *Festuca idahoensis* subsp. *roemerii*, Pavlick, 1992, personal communication.

⁵ note that in older taxonomic keys *Bromus carinatus* was assignable to *B. sitchensis* (Roemer, Hans, 1992, personal communication. Ecologist. B.C. Ecological Reserves program).

fir transition forest on Saturna and Mayne Islands (Janszen, 1977, 1981).

Pattison and Karanka (1981) named a Garry Oak - hairy honey suckle - California fescue (oatgrass ?) vegetation unit. *Danthonia californica* and *Lonicera hispidula* were the species referred to. Salstrom (1989) identified a *Pseudotsuga menziesii*-*Quercus garryana* / *Lonicera hispidula* woodland from Pt. Disney, Waldron Island, Washington.

Roemer (1972) described the *Arbutus-Pseudotsuga* association, in which oak was of minor importance. Similar communities were noted by Szczawinski and Harrison (1973) for the Saanich Peninsula; Oswald (1977) for Gabriola Island; van Vliet et al., (1987) for Saltspring Island; Pattison and Karanka, (1981) for Galiano, Valdes and Thetis Islands; and Janszen (1977; 1981) for Saturna and Mayne Islands.

Salstrom (1989) described two communities for Pt. Disney, Waldron Island, Washington, which are unique in the literature. These are the *Quercus garryana* / *Galium aparine* woodland and the *Bromus rigidus* / moss (*Rhacomitrium canescens*) grassland, with which oak was associated.

The *Quercus/Amelanchier/Symphoricarpos* community (Thilenius, 1964, 1968, Willamette Valley, Oregon) has related communities which are very widespread. Similar types occur in the Saanich Peninsula (Roemer, 1972, Pojar, 1980b) and the Capital Regional District (McMinn et al., 1976); on Galiano, Valdes, and Thetis Islands (Pattison and Karanka, 1981); on Saturna and Mayne Islands (Janszen, 1977; 1981); in the Washougal River Valley, Clark County, and in Oakville, Grays Harbour County, Washington (Taylor and Boss, 1975); in the Badger allotment of Mt. Hood National Forest, Oregon (Williams (1978⁶); and in the Bald Hills oak woodlands of Redwood National Park (Sugihara et al., 1987).

Communities dominated by *Rhus diversiloba* are also widespread, but not in British Columbia or western Washington (Hedrick et al., 1959, for Corvallis, Oregon;

⁶ Williams' (1978) *Symphoricarpos* was "*mollis*", though. Previous work in the Mill Creek Research Natural Area by Fred Hall had identified communities with *S. albus*.

Thilenius, 1964, 1968; Smith, 1985 for the Umpqua and Rogue River Valleys of s.Ore.; Riegel et al., 1992 for s.Ore., Sugihara et al., 1987 and Keeler-Wolf, 1992 for the Soldier Research Natural Area near the n.fork, Eel R., n.California). The *Quercus garryana*/*Rhus diversiloba*/*Dactylus glomerata* type (Smith, 1985) is also widespread, although not always with *Rhus* present (Sugihara et al., 1987; Riegel et al., 1992; Thilenius, 1964, 1968; Pattison and Karanka, 1981).

The introduced *Cynosurus echinatus* is a dominant species in several areas studied (Smith, 1985; Sugihara et al., 1987; Riegel et al., 1992; Keeler-Wolf, 1990; Roemer, 1972).

Riegel et al.(1992) described the *Quercus garryana*-*Pseudotsuga menziesii*/*Elymus glaucus* community. Similar types have also been recorded by Hall et al. (1959); Sugihara et al. (1987); Thilenius (1961); Keeler-Wolf (1990); Franklin (1972) for the Mill Creek Research Natural Area south of Hood River, Oregon; and by Roemer (1972). It has also been suggested that *Elymus glaucus* may have been one of the major dominants of the California grasslands (George et al., 1992) and of portions of the coastal prairie (Heady et al., 1977). The dominance of *Elymus glaucus* was described by Aldrich (1972) in his provisional association from the "balds" of the Oregon Coast Range: a non-forested, non-oak type.

Riegel et al.(1992) outlined a *Quercus garryana*/*Bromus carinatus* community. Related types were also described by Sugihara et al.(1987); Heady et al.(1977); Aldrich (1972); Roemer (1972); and Pattison and Karanka (1981, *B.sitchensis*⁷).

Communities noted for *Holodiscus discolor* are also well represented across the geographic range (Sugihara et al., 1987; Kuchler, 1977; Thilenius, 1964; Taylor and Boss, 1975; Cadrin, 1992, for se. Vanc.Is.; McMinn et al., 1976; Roemer, 1972; Pattison and Karanka, 1981; and Janszen, 1977; 1981).

⁷ note that in certain taxonomic keys *Bromus carinatus* was assignable to *B. sitchensis* (Roemer, 1992, personal communication).

APPENDIX 2 PLOT FORMS AND CATEGORIES: FORMS cont.

SOIL DESCRIPTION	SOIL CLASSIF _____ TERRAIN CLASSIF _____		PROFILE DIAGRAM				
	HUMUS FORM _____ DRAINAGE CLASS _____						
	ROOTING DEPTH _____ cm		ROOT RESTRICTING TYPE _____				
	SEEPAGE WATER DEPTH _____ cm		LAYER DEPTH _____ cm				
	HUMUS						
	HORIZON	DEPTH	F A B R I C STRUCTURE / CONSIST / CHAR / TEXTURE	R O O T S A B SIZE	M I S C E L L A N E O U S C O M M E N T S		
MINERAL SOIL							
HORIZON	DEPTH	C O U L O U R	A _p T E X T U R E	% C O A R S E F R A G S G C S T O T	R O O T S A B SIZE	M I S C.	C O M M E N T S
NOTES: _____							

MENSURATION - WILDLIFE - NOTES	MENSURATION																		
	TREE SPECIES	D.B.H.	C/C	H E I G H T C A L C U L A T I O N S							A G E C A L C U L A T I O N				S I T E I N D E X				
				T O P	B O T	T O T A L	% S	S. D.	H. D.	C O R.	H E I G H T	C O U N T	B/H	P. C O R.	H T. C O R.	A G E			
WILDLIFE REMARKS (TRACKS, SCATS, % UTILIZATION) : _____																			
RANGE REMARKS (CONDITION, UTILIZATION, PRODUCTIVITY) _____																			
NOTES: _____																			

APPENDIX 2 PLOT FORMS AND CATEGORIES: CATEGORIES

Plot information
Comments
date
Environmental Information
site sketch map and plot sketch map
elevation
% slope
aspect
surface shape
ecological moisture regime
successional status
exposure
bedrock geology
substrate cover class
humus/bedrock
bedrock
rocks
mineral soil
dead wood
soil classification and description
humus classification and description
depth of the Ah horizon
colour of the Ah horizon
depth to bedrock
soil texture
coarse fragments

APPENDIX 2 FORMS AND CATEGORIES: CATEGORIES cont.
species cover class by structural layer (A1-3; B1,2; C, D layer)
species phenology code
species utilization
species signs of hedging
total cover class of the dominant epiphytic vegetation (mosses, lichens-foliose, fruticose)
diameters by tree species and occasional shrubs
assessment of "fit" for <i>Quercus garryana</i> compared with the Bolsinger form classes
assignment of the Bolsinger form class for <i>Quercus garryana</i> individuals
bird species presence, with individual notations
list of other species on the plot
utilization by deer, with notes. where appropriate: other species as well.
scats noted
Habitat features:
bedrock or rock crevices
bedrock cavities
bedrock/soil junction cavities
bark crevices
burrows
dead stems
small dead limbs
medium-sized dead limbs
large dead limbs
bark-scaling limbs
rotten limbs

APPENDIX 2 FORMS AND CATEGORIES: CATEGORIES cont.
loose bark
oak crevices or cavities
oak hollows
perches
furrowed bark
woody down debris
Comments
Comments on structural diversity
Pathology of oak: outbreaks

92	THETIS IS.		notes	93	KNOCKAN HILL		KH01 to 04
	YELLOW PT.		notes		BEAR HILL		BRH01 to 04
	NANAIMO	JACK PT.	notes		GLENDALE L.		GLA01 to 06
	DENMAN IS.		notes		OBSERVATORY HILL		OH01 to 03
	HORNBY IS.	HELLJWELL PK	notes		GABRIOLA IS	FALSE NARROWS	notes
		FORD COVE	notes			DRUMBEG PK area	DI01 to 06
	FT RODD HILL		FR01 to 05		GOLDSTREAM		notes
	JUAN DE FUCA		IDF01		NANAIMO...	NECK PT	NP01
	GONZALES HILL		GZ01			HAREWOOD PLAINS	notes
	N. SAANICH		notes			NEWCASTLE	NI01
	SOMENOS LK.		SOD1,02			WESTWOOD	WE01
	BEAVER LK		BL01			PIPERS LAGOON	PI01,02
	WOODSEND R.		HR01 to 03		FLORENCE LK.		notes
	BEACON HILL PK.		notes	94	PORTAGE PK.		notes
	ANDERSON HILL PK.		notes		KNOCKAN HILL		KH01B to 03B
	MT DOUG		MD01 to 03		MARIOOLD PK.		notes
	COWICHAN VALLEY		CV01		CAIRN PARK		notes
	COWICHAN BAY		CB01		FT RODD HILL		FR02B,04B
	MAPLE BAY		MB01		SUMMITT PK		SU01B,
	HORTH HILL		HH01				* 02 to 05
	LOHBRUNNER		LO01		MARY HILL		MA01 to 04
	WALBRAN PK		WB01		ROCKY PT		RP01 to 07
	FRANCES-KING PK		FK01		NADEN HILL		NA01 to 05
	W CHATHAM IS.		WC01		PENDER IS.	CUTLASS RD.	PE01,02
	ROBINFIELD FARMS		RF01			HERMIT HILL	PE03 to 05
	GLENDENNING DR		GL01,02			STANFORD HILL	PE06
	ELDERBUSH PLACE		EP01			GOWLAND PT.	PE07,10
	SANTA ROSA DR		SR01			GEORGE HILL	PE08,09
	SOMENOS LK.		notes			OAK BLUFFS	PE11,12
93	MT TZUHALEM		TZ01 to 05			BEDWELL HARBOUR	notes
	PRIEST PT.		PP01 to 03		OBSERVATORY HILL		OH01B to 03B
	GENOA BAY		GB01 to 04				OH04 to 07
	ST. PETER'S CHURCH		SP01		UVIC plots		UV01,02
	BEACON HILL PK.		BHP01 to 03		THETIS LK		TH01 to 10
			BHP01B to		MAYNE IS	EDITH PT.	MN01
			BHP03B			MT. PARKE	MN01
	ANDERSON HILL PK.		AHP01, 01B			s. of HECK HILL.	MN03
	UPLANDS PK.		UP01 to 09		MT DOUG		MD01C to 03C
			UP01B to 05B				* 06
			UP05C		GLENDALE LANDS		GLA01B - 06B
	GONZALES HILL		GZ01B, GZ02				* 07
	WALBRAN PK.		WB01B		JOCELYN HILL		notes
	DENMAN IS.	LACON RD.	DI01		GALLIANO IS	BELLHOUSE PT.	GAL101
	HORNBY IS.	DOWNES PT.	HE02			ARBUTUS PT.	GAL102,03
		THOUSAND OAKS	HE01, HE01B			MONTAGUE HARBOUR	GAL104
	NANOOSE BAY		NB01 to 04			BODEGA RIDGE	GAL105,06
	DOLPHIN BAY		NH01			DIONISIO PK.	GAL107 to 10
	NANOOSE HILL		NH02 to 06			BLUFFS PK.	notes
	SAXE PT		SX01,02			MATHEWS PT.	GAL111
	SONGHEES - CRAWFLOWER		SG01			MARY ANN PT.	GAL112
	COLWOOD- DND		CO01 to 04			SALALIKIM ROCK	GAL113,17,18
	JUAN DE FUCA PK.		JDF01B,			MT. GALLIANO	GAL114 to 16
			* 02 to 07			TSUHEM HARBOUR	TS01
	BELMONT PK.		notes			WOODLEY RANGE	WO01
	ESQUIMALT LAGOON		notes		YELLOW PT	SHARPE PT.	notes
	SATURNA IS.	EAST PT.	SA06 to 08			KULLETT BAY	notes
		MT. WARBURTON-PIK	SA04,05			DEER PT.	YE01,02
		ELIJOTT BLUFF	SA01 to 03			YELLOW PT.	YE03
	SUMMIT PK.		SI01			FLEWITT PT.	YE04 to 06
	SALTSPRING IS.	RUCKLE PT.	SS01 to 05			BOATHOUSE HARBOUR n.	YE07 to 09
		BURGOYNE BA	SS06			REYNOLDS PT.	YE10
		REGINALD HILL	SS07,08			JOAN PT. s.	notes
		MT. TUAM	SS09 to 12		BENVENUTO	WATER TOWER H.	BN01 to 10
		MT. MAXWELL	SS13 to 17		NANAIMO	JACK PT	JP01 to 04
		CHANNEL RIDGE	SS18,19			HAREWOOD PLAINS	HA01,02
	MT. DOUG		MD01B to 03B		SONGHEES- WEST BAY		SO02,03
			MD04,05		BEACON HILL		BHP04
	E. SOOKE RD.		ES01		PANAMA HILL		PA01,02
	PEDDER BAY		ES02 to 06		PORTLAND IS		PI01,02
	LESTER PEARSON COLLEGE n.		LP01 to 04		GORE PK		GO01
	WITTY'S LAGOON		WL01		MT. WORK		MW01
	MILL HILL		MH01 to 04		LONE TREE HILL		LTH01 to 04
	SKIRT MT		SKM01 to 03		TUMBO IS.	rocky islet	TU01,02
	MT FINLAYSON		MF01 to 03		CABBAGE IS.		CA02,03
	SCAPE HILL		SH01 to 03				

APPENDIX 4. CLASSIFICATION OF 1992 GARRY OAK PLOTS IN B.C.

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AREA	PLOTS	CLASSIFICATION	no. of plots, where 5 or less
FT RODD HILL	FR01	n/a	
	FR02	c28a	
	FR03	n/a	
	FR04	c6	
	FR05	c31a	
JUAN DE FUCA	JDF01	c3	
GONZALES HILL	GZ01	c15- revisited	
SOMENOS LK.	SL01	c28a	
	SL02	c28a	
BEAVER LK	BL01	c10	5
WOODSEND R.	HR01	c45	5
	HR02	c29a	
	HR03	c46	4
MT DOUG	MD01	n/a: post-burn	
	MD02	n/a: post-burn	
	MD03	n/a: post-burn	
COWICHAN VALLEY	CV01	c10	5
COWICHAN BAY	CB01	c22	4
MAPLE BAY	MB01	c29a	
HORTH HILL	HH01	c15	
LOHBRUNNER	LO01	c47	
WALBRAN PK	WL01	c15	
FRANCES-KING PK	FK01	c28a	
W CHATHAM IS.	WC01	c31a	
ROBINFIELD FARMS	RF01	c28a	
GLENDENNING DR	GL01	c6	
	GL02	c28a	
ELDERBUSH PLACE	EP01	c28a	
SANTA ROSA DR	SR01	c9	

APPENDIX 5 NUMERICAL LIST OF PLANT COMMUNITIES

- c2 Oak - Broom - *Cynosurus echinatus* (late season)
- c3 Oak - Broom - *Rhacomitrium canescens*- *Festuca bromoides* - *Aira* subcommunity
- c4 Oak - Broom - *Poa pratensis*
- c5 Oak - Broom - *Dactylis glomerata*
- c6 Oak - Broom - *Elymus glaucus*
- c8 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (thickets)
- c9 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity (thickets)
- c10 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadelphus triquetris*
- c11 Oak - *Dicranum scoparium* - *Montia parvifolia* subcommunity
- c13 Oak - *Melica subulata*
- c14 Oak - *Carex inops*
- c15 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza*
- c16a Oak - *Lonicera hispidula* (colluvial)
- c17 Oak - Broom - *Rhacomitrium canescens*: *Typic* subcommunity
- c20 Oak - *Festuca idahoensis*: *Typic*
- c21 Oak - *Cynosurus echinatus* (late season)
- c22 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum* subcommunity
- c23 Oak - *Bromus sterilis*
- c25 Oak - *Festuca idahoensis* - *Cerastium arvense* subcommunity
- c26 Oak - *Mahonia aquifolium*
- c27 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity
- c28a Oak - *Dactylis glomerata*: *Typic* subcommunity
- c28b Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity

APPENDIX 5 NUMERICAL LIST OF PLANT COMMUNITIES cont.

- c29a Oak - *Poa pratensis* - *Vicia sativa*
- c30 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity
- c31a Oak - *Anthoxanthum odoratum*
- c31b Oak- Broom - *Anthoxanthum odoratum*
- c35a Oak - *Camassia quamash* - *Erythronium oregonum* subcommunity (early season)
- c35b Oak - *Camassia quamash* - *Dodecatheon hendersonii* subcommunity (early season)
- c36 Oak - *Camassia leichtlinii* (early season)
- c37a Oak - *Camassia quamash*: Typic subcommunity (early season)
- c37b Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity (early season)
- c41 Oak - *Lathyrus nevadensis*
- c42 Krummholz Oak - *Festuca idahoensis* - *Vicia americana* (sea-edge) subcommunity
- c43 Oak - *Bromus carinatus*
- c45 Oak - *Dicranum scoparium* - *Sedum spathifolium* subcommunity
- c46 Oak - (Fd) - *Rhacomitrium canescens* - *Selaginella wallacei* subcommunity
- c47 Oak - *Elymus glaucus*
- c48 Oak - *Montia perfoliata* (early season)
- c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity
- c50 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity
- c51 Oak - *Dicranum scoparium* - *Plectritus congesta* subcommunity (early season)
- c52 Oak - *Dicranum scoparium*: Typic subcommunity

APPENDIX 6 PLANT COMMUNITIES AND SUBCOMMUNITIES LISTED BY CLASSIFICATION

(Subcommunities grouped together to show relationships, plant communities grouped as 'unrelated')

c46 Oak - (Fd) - *Rhacomitrium canescens* - *Selaginella wallacei* subcommunity

c50 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity

c52 Oak - *Dicranum scoparium*: Typic subcommunity

c11 Oak - *Dicranum scoparium* - *Montia parvifolia* subcommunity

c45 Oak - *Dicranum scoparium* - *Sedum spathifolium* subcommunity

c51 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (early season)

c37a Oak - *Camassia quamash*: Typic subcommunity (early season)

c35a Oak - *Camassia quamash* - *Erythronium oregonum* subcommunity (early season)

c35b Oak - *Camassia quamash* - *Dodecatheon hendersonii* subcommunity (early season)

c37b Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity (early season)

unrelated: c36 Oak - *Camassia leichtlinii* (early season)

c48 Oak - *Montia perfoliata* (early season)

c20 Oak - *Festuca idahoensis*: Typic subcommunity

c25 Oak - *Festuca idahoensis* - *Cerastium arvense* subcommunity

c27 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity

c42 Krummholz Oak - *Festuca idahoensis* - *Vicia americana* subcommunity (sea-edge)

unrelated: c41 Oak - *Lathyrus nevadensis*

c43 Oak - *Bromus carinatus*

c47 Oak - *Elymus glaucus*

APPENDIX 6 PLANT COMMUNITIES AND SUBCOMMUNITIES LISTED BY CLASSIFICATION cont.

- unrelated: **c13** Oak - *Melica subulata*
 c14 Oak - *Carex inops*
 c16a Oak - *Lonicera hispidula* (colluvial)
 c26 Oak - *Mahonia aquifolium*
- c10** Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadelphus triquetris*
c15 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza*
- c8** Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (thickets)
c9 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity (thickets)
- unrelated: **c21** Oak - *Cynosurus echinatus* (late season)
 c23 Oak - *Bromus sterilis*
 c29a Oak - *Poa pratensis*
 c31a Oak - *Anthoxanthum odoratum*
- c28a** Oak - *Dactylis glomerata*: Typic subcommunity
c28b Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity
c30 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity
c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity
- c3** Oak - Broom - *Rhacomitrium canescens* - *Festuca bromoides* - *Aira* subcommunity
c17 Oak - Broom - *Rhacomitrium canescens*: Typic subcommunity
c22 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum* subcommunity
- c2** Oak - Broom - *Cynosurus echinatus* (late season)
c31b Oak - Broom - *Anthoxanthum odoratum*
c4 Oak - Broom - *Poa pratensis*
c5 Oak - Broom - *Dactylis glomerata*
c6 Oak - Broom - *Elymus glaucus*

APPENDIX 7 LIST OF CONSOLIDATED GROUPINGS OF PLANT COMMUNITIES

Early Season Plant Communities:

- c37a Oak - *Camassia quamash*: Typic subcommunity
- c35a Oak - *Camassia quamash*- *Erythronium oregonum* subcommunity
- c35b Oak - *Camassia quamash* - *Dodecatheon hendersonii* subcommunity
- c37b Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity
- c36 Oak - *Camassia leichtlinii*
- c48 Oak - *Montia perfoliata*
- c51 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (also below)

Native Plant Communities of Bedrock Outcrops

- c51 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity (early season) (also above)
- c11 Oak - *Dicranum scoparium* - *Montia parvifolia* subcommunity
- c45 Oak - *Dicranum scoparium* - *Sedum spathifolium* subcommunity
- c52 Oak - *Dicranum scoparium*: Typic subcommunity
- c46 Oak - (Fd) - *Rhacomitrium canescens* - *Selaginella wallacei* subcommunity

Other Native Plant Communities (dry to wet):

- c26 Oak - *Mahonia aquifolium*
- c16a Oak - *Lonicera hispidula* (colluvial)
- c20 Oak - *Festuca idahoensis*: Typic subcommunity
- c25 Oak - *Festuca idahoensis* - *Cerastium arvense* subcommunity
- c27 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity
- c42 Krummholz Oak - *Festuca idahoensis* - *Vicia americana* subcommunity (sea-edge)

Other Native Plant Communities (dry to wet, cont.):

- c47 Oak - *Elymus glaucus*
- c41 Oak - *Lathyrus nevadensis*
- c43 Oak - *Bromus carinatus*
- c14 Oak - *Carex inops*
- c13 Oak - *Melica subulata*
- c15 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza*
- C10 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadelphus triquetris*

- c8 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity (thickets)
- c9 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity (thickets)

APPENDIX 7 LIST OF CONSOLIDATED GROUPINGS OF PLANT COMMUNITIES (cont.)

First-Order Disturbance Plant Communities (dry to wet):

- c50 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity
- c21 Oak - *Cynosurus echinatus* (late season)
- c23 Oak - *Bromus sterilis*
- c31a Oak - *Anthoxanthum odoratum*
- c29a Oak - *Poa pratensis* - *Vicia sativa*
- c28a Oak - *Dactylis glomerata*: Typic subcommunity
- c28b Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity
- c30 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity
- c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity

Second-Order Disturbance Communities (Broom series)

Bedrock outcrops:

- c3 Oak - Broom - *Rhacomitrium canescens* - *Festuca bromoides* - *Aira* subcommunity
- c17 Oak - Broom - *Rhacomitrium canescens*: Typic subcommunity
- c22 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum* subcommunity

Other Second- Order Disturbance Communities (Broom series) (dry to wet):

- c2 Oak - Broom - *Cynosurus echinatus* (late season)
- c31b Oak - Broom - *Anthoxanthum odoratum*
- c6 Oak - Broom - *Elymus glaucus*
- c4 Oak - Broom - *Poa pratensis*
- c5 Oak - Broom - *Dactylis glomerata*

APPENDIX 8. SHORT VERSION OF EARLY SEASON PLANT COMMUNITIES

File = 934vwb8a.xls (9601031)

	file=934-C51.xls	FILE=934_C35B_XL	file=934-C37A.xls	file=934-C37B.xls	file=934-C35A.xls	file=934-c36.xls	file=934-c48.					
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-					
	DICR SCOP-	CAMA QUA-	CAMA QUA:	CAMA QUA-	CAMA QUA-	CAMA LEI	MONT PER					
	PLECT CON S.C.	DODE HEN S.C.	TTYPIC	RANU OCC S.C.	ERYTH ORE S.C.							
	n=3	n=4	n=12	n=6	n=5	n=50	n=12					
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV					
	COV	COV	COV	COV	COV	COV	COV					
Festbro	0.6667	0	0.25	2.0417	0.1667	1	0	0.64	4.1	0.6667	9.2917	
Seduspa	0.4333	0.25	0.125	0.0833	0.0417	0	0	0.2	1.2	0.1	0.4	
Heucmic	0.6667	0.25	0.125	0.0833	0.0417	0	0	0.2	0.1	0.04	0.13	
Anthodo	0.3333	0.5	0.25	0.5833	7.25	0	0	0.4	4.8	0.46	6.71	
Eurthore	0.6667	0	0	0.25	2.5	0.6667	3.25	0.4	1.2	0.34	3.16	
Rubbuurs	0.3333	0	0	0	0	0.1667	1	0.2	1.2	0.08	0.39	
HolodisB1	0.6667	0.25	4.5	0.1667	5.75	0.3333	2	0.4	13.8	0.28	5.96	
Osmochi	0.3333	0	0	0.1667	1	0	0	0.2	0.1	0.18	0.42	
Corarar	0.6667	0.5	1.625	0.25	0.125	0.3333	3.0833	0.2	1.2	0.4	1.56	
Polymun	0.6667	0	0	0.3333	0.1667	0.1667	0.0833	0	0	0.14	0.18	
Delpmen	0.6667	0	0	0.0833	0.0417	0.1667	0.0833	0.2	0.1	0.22	1.25	
Melsub	0.6667	0	0	0.3333	6.8333	0.1667	0.0833	0	0	0.26	2.32	
Brommol	0.6667	0	0	0.25	1.5833	0.3333	2	0.2	0	0.52	1.71	
Montpar	0.6667	0.25	0.125	0	0	0	0	0.2	3.6	0.14	0.4	
Geramol	0.6667	0	0	0.4167	3.0417	0.5	2.0833	0	0	0.48	2.52	
Viciame	0.6667	0.25	0.125	0.25	0.125	0	0	0.4	1.3	0.32	3.08	
Rlyuri	0.6667	0.5	6	0.25	4.1667	0	0	0.2	7.6	0.2	4.24	
Collpar	0.6667	0.75	1.75	0.25	0.125	0.3333	1.0833	0.2	0.1	0.1	0.27	
Pleccon	0.6667	0.75	1.75	0.3333	1.0833	0.1667	1	0.2	0.1	0.2	0.89	
CyiscoB2	0.6667	0.75	1.75	0.5833	14.292	0	0	0.4	0.2	0.66	10.3	
Bromcar	0.6667	0.75	1.75	0.5833	2.2083	0.6667	5.0833	0.4	1.3	0.66	4.89	
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE > = 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:								SPECIES IN AT LEAST	SPECIES WITH >=0.70			
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.												

APPENDIX 8. SHORT VERSION OF EARLY SEASON PLANT COMMUNITIES

File = 934vrb8a.xls (9601031)

	file=934-C51.xls	FILE=934-C35B.XL	file=934-C37A.xls	file=934-C37B.xls	file=934-C35A.xls	file=934-c36.xls	file=934-c48.xl
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
	DICR SCOP-	CAMA QUA-	CAMA QUA:	CAMA QUA-	CAMA QUA-	CAMA LEI	MONT PER
	PLECT CON S.C.	DODE HEN S.C.	TYPIC	RANU OCC S.C.	ERYTH ORE S.C.		
	n=3	n=4	n=12	n=6	n=5	n=50	n=12
	PRES	AV	PRES	AV	PRES	AV	PRES
	COV	COV	COV	COV	COV	COV	COV
Dierco	14	0.75 4.5	0.25 1.0417	0.1667 3	0.4 4.8	0.28 2.64	0.4167 6.7917
Daciglio	0.6667 8	0.5 0.25	0.4167 6.25	0.3333 6.0833	0.3 6.1	0.62 10.96	0.3333 2
Eryore	0.6667 2.1667	0.5 4.625	0.3333 1.0833	0.5 2.0833	1 28.6	0.3 1.45	0.25 0.5833
Symptalbb2	1 4.5	0.75 6.125	0.75 12.0833	0.6667 6	1 21.2	0.84 16.1	0.5833 7.7083
Vicist	0.6667 2.1667	0	0.6667 3.625	1 6.1667	0.6 2.5	0.74 6.6	0.5833 5.7917
Vicibir	0.6667 0.3333	0.5	0.5833 5.5833	0.5 4.0833	0.4 1.3	0.7 6.72	0.5833 2.6667
Camalci	1 20.667	0	0.1667 1	0.1667 1	0.2 3.6	1 22	0.5833 9.75
Elymgla	0.6667 2.1667	1 4.625	0.6667 5.0833	0.5 1.1667	0.4 1.3	0.84 8.17	0.9167 6.6667
Sanicra	3 8.1667	0.75 1.75	1 10.542	0.5 5	0.4 1.3	0.76 6.56	0.75 8.5
Sietned	0.6667 0.3333	1 0.5	0.6667 3.1667	0.8333 3.1667	0.6 0.3	0.42 1.44	0.75 5.5833
Poa pra	0.6667 8	0.25 0.125	0.6667 7.0833	1 9.5	0.6 6	0.76 10.24	0.75 6.3333
Bromisc	0.6667 2.1667	0.25 0.125	0.3333 2.0833	0.6667 10.417	0 0	0.66 5.7	0.6667 5.8333
Momper	1 14.8333	0.25 0.125	0.5 2.625	0.3333 1.0833	0 0	0.42 3.05	1 23
Galapa	1 14	1 1.25	0.9167 3.75	0.6667 4.1667	0.6 2.5	0.86 6.72	0.5833 15.292
Rumace	0.3333 0.1667	0.75 0.375	0.5833 1.6667	0.3333 0.1667	0.2 1.2	0.34 0.5	0.5833 1.2083
Achinil	0.3333 0.1667	1 0.5	0.25 0.5833	0.1667 1	0 0	0.34 0.96	0.5 1.1667
Rhaccan	0.3333 2	1 15.625	0.1667 2	0.1667 1	0.2 1.2	0.26 3.32	0.0833 3.1667
Brodcor	0.3333 2	0.75 0.375	0.5833 7.7083	0.3333 1.0833	0.6 4.9	0.38 1.42	0.25 1.0417
Carcino	0 0	0.75 6.125	0.5833 9.3333	0.3333 6	0.6 4.9	0.24 0.69	0.5 2.625
Lomaur	0.3333 2	0.75 1.75	0.5 1.1667	0.5 3	0.2 0.1	0.12 0.17	0.0833 0.0417
Polyjun	0.3333 2	1 4.625	0.0833 0.5	0 0	0.2 1.2	0.06 0.36	0.1667 1
Dodelen	0 0	1 14	0.4167 1.125	0.3333 0.1667	0.2 0.1	0.26 0.46	0.1667 0.5417
Luzumul	0 0	0.75 1.75	0.25 0.5833	0.1667 1	0.4 0.2	0.12 0.06	0.1667 0.5417
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:							
	SPECIES USED IN NAMING		SPECIES WITH >= 0.70				
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.							

	file=934-C51.xls	FILE=934_C35B.XL	file=934-C37A.xls	file=934-C37B.xls	file=934-C35A.xls	file=934-c36.xls	file=934-c48.XL							
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-							
	DICR SCOP-	CAMA QUA-	CAMA QUA:	CAMA QUA-	CAMA QUA-	CAMA LEI	MONT PER							
	PLECT CON S.C.	DODE HEN S.C.	TYPIC	RANU OCC S.C.	ERYTH ORE S.C.									
	n=3	n=4	n=12	n=6	n=5	n=50	n=12							
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV							
	COV	COV	COV	COV	COV	COV	COV							
Trifol	0	0.75	0.195	0.0833	0.0417	0.1667	0.0833	0	0.06	0.03	0	0		
MahoquB2	0.3333	0.1667	0.75	0.375	0.5833	4.0417	0.1667	1	1.4	2.6	0.54	2.86	0.25	1.5
Camagua	0	0	1	10.625	1	2.417	1	2.9633	1	2.2	0.22	1.82	0.3333	2.5417
Ranucec	0	0	0	0	0.1667	0.0833	1	11.633	0.4	1.3	0.36	0.62	0.25	0.5833
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE > = 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:														
		SPECIES USED IN NAMING			SPECIES WITH >= 0.70									
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.														
TOTALS FOR THE PLANT COMMUNITIES:														
TOTAL COVER	789.5	770.5	2395.5	1217	416	962	11281	3087						
DOMINANT COVER	656.5	525.5	585.5	416	0.3418	403.5	4155.5	1223						
DOM/TOT COV	0.8315	0.682	0.2444	0.3418	0.4194		0.3684	0.3962						
TREE LAYER SPECIES WITH > = 0.70 IN AT LEAST ONE COMMUNITY														
Quercus A	1	54.667	0.75	10.5	0.8333	48.333	0.8333	48.333	0.6	31.4	0.72	33.94	0.5	24.167
Quercus B1	1	14	1	12	0.8333	21.617	0.5	13.667	0.8	29	0.6	30.48	0.9167	25.333
Quercus B2	0.0667	4	0.25	1.5	0.75	5.0417	0.9333	11.667	0.6	12.4	0.28	9.73	0.0667	3.933
Quercus D	1	2.5333	1	1.875	0.5833	4.75	0	0	0.6	1.4	0.36	2.42	0.9167	4.2917
Pseudea A	0	0	0.75	4.5	0.25	4.1667	0	0	0.4	2.4	0.18	2.92	0.1667	3
Pseudea B1	0	0	0	0	0	0	0	0	0	0	0.06	0.36	0.1667	1
Pseudea B2	0	0	0	0	0	0	0	0	0.2	3.6	0.02	0.12	0.1667	0.5417
Pseudea D	0	0	0.25	0.125	0	0	0.1667	0.0833	0	0	0.02	0.01	0.25	0.125

APPENDIX 8. SHORT VERSION OF NATIVE PLANT COMMUNITIES: BEDROCK OUTCROPS AND OTHER COMMUNITIES (FMB7a1.xls (9/30/12))

	file=934-C11.xls	file=934-C52.xls	file=934-C45.xls	file=934-C46.xls	file=934-C26.xls	file=934-C16A.xls
	OAK-	OAK-	OAK-	OAK- (Fd)-	OAK-	OAK-
	DICR SCOP-	DISC SCOP:	DISCR SCOP-	RHAC CAN-	MAHO AQUIT	LONT HISP
	MONT PAR S.C.	TYPIC	SEDU SPA S.C.	SELA WAL S.C.	N=4	N=9
	N=7	N=4	N=5	N=4	PRES AV	PRES AV
	PRES AV	PRES AV	PRES AV	PRES AV	COV	PRES AV
	COV	COV	COV	COV	COV	COV
BEDROCK OUTCROPS						
OTHER COMMUNITIES						
Montpar	1	0	0	0	0	0
Atrapra	0.8571 7.25	0.5	0.4	0.75 1.75	0	0.1111 0.6667
Anthodo	0.7143 14.333	0.75	0.2	0.25 0.125	0.25	0.3333 4.3333
Montper	0.7143 14.333	0.25	0.2	0.25 0.125	0.25	0.2222 0.7222
Polygly	0.8571 4.6667	0.25	0.6	0	0	0
Rhytri	0.7143 28.667	0	0.2	0	0.25	1.5
Bromcar	0.7143 3.1667	0.25	0.6	1	3.25	0.6667 6.6667
Elymagla	1	0.75	0.6	1	10.625	0.8889 0.6111
Galiapa	1	0.75	0.8	0.5	6.125	0.8889 10.667
SynpalbB2	0.7143 8.5	0.75	1	0.25	0.125	0.4444 6.9444
Diersco	0.8571 28.5	1	0.8	0.25	1.5	0.3333 2
Lomutic	0	0.75	0.4	0.75	3.125	0.25 0.125
Rhaecan	0.1429 1	0.75	0.4	0.75	29.75	0.5 3
Festidah	0.1429 1	0.75	0.6	0.5	3	0.5 0.25
Festbro	0.5714 3.25	0.75	0.6	0.75	4.75	0.5 6
Lombis	0.1429 3	0.75	0.4	0.5	6	1
Seduspa	0.4286 4.0833	0.5	1	0.25	1.5	0.5 0.25
Selawal	0.4286 0.25	0.5	0.4	1	25	0.25 1.5
Luzumul	0.5714 1.25	0	0.4	0.75	4.75	0.25 0.125
Polyjun	0.5714 6	0.5	0.4	0.75	10.5	0 0
Collpar	0.2857 1.0833	0.5	0.2	0.75	1.125	0 0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE > = 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:						
				SPECIES USED IN MAPPING		SPECIES RE
Species designations consist of the first 4 letters of the genus followed by the first 3 letters of the species.						

APPENDIX 8. SHORT VERSION OF NATIVE PLANT COMMUNITIES: BEDROCK OUTCROPS AND OTHER COMMUNITIES (FY067a1.xls (9660121))

	file = 934-C11.xls	file = 934-C52.xls	file = 934-C45.xls	file = 934-C46.xls	file = 934-C26.xls	file = 934-C16A.xls
	OAK-	OAK-	OAK-	OAK- (Fd)-	OAK-	OAK-
	DICR SCOP-	DISC SCOP:	DISCR SCOP-	RHAC CAN-	MAHO AQUI	LONT HISP
	MONT PAR S.C.	TYPIC	SEDU SPA S.C.	SELA WAL S.C.		
	N=7	N=4	N=5	N=4	N=4	N=9
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV
	BEDROCK OUTCROPS					
	Lathnev	0.1429 0.0833	0.25 0.125	0.4 3.7	0 0	0 0
	Ranuoc	0.1429 1	0.25 4.5	0 0	0.25 0.125	0.3333 0.7778
	Danical	0.1429 0.0833	0 0	0 0	0.25 1.5	0.2222 1.3333
	Melisub	0.2857 4	0.25 0.125	0.6 7.3	0.25 4.5	0.4444 2.7778
	HolodisB2	0.1429 0.0833	0.5 4.625	0.6 17.4	0 0	0.3333 3.3333
	HolodisB1	0.2857 11.5	0.25 1.5	0.2 3.6	0.25 4.5	0.3333 1.3889
	Cytiscob2	0.5714 0.3333	0.5 1.625	0.2 0.1	0.5 6	0.2222 0.7222
	Areamac	0.4286 3.1667	0 0	0 0	0 0	0.1111 0.0556
	Stelmed	0.2857 0.1667	0.25 1.5	0.2 0.1	0 0	0.3333 0.7778
	Eryore	0.4286 3.1667	0.25 0.125	0.4 0.2	0 0	0.1111 0.0556
	Fritlan	0.1429 0.0833	0.25 0.125	0 0	0.25 0.125	0.2222 0.7222
	LonicilB1	0 0	0 0	0 0	0 0	0 0
	Lonicil	0.1429 0.0833	0.25 0.125	0.2 1.2	0.25 0.125	0 0
	RosautB1	0 0	0 0	0 0	0 0	0 0
	Rosanut	0 0	0.25 1.5	0 0	0.25 1.5	0.1111 0.6667
	Oemicer	0 0	0 0	0 0	0 0	0 0
	OemicerB2	0 0	0 0	0.2 0.1	0 0	0 0
	Daphlau	0.1429 0.0833	0.25 4.5	0 0	0 0	0 0
OTHER COMMUNITIES						
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE > = 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:						
Species designations consist of the first 4 letters of the genus followed by the first 3 letters of the species.						

APPENDIX 8. SHORT VERSION OF NATIVE PLANT COMMUNITIES: BEDROCK OUTCROPS AND OTHER COMMUNITIES (PWB7a1.xls (960121))

	file = 934-C11.xls	file = 934-C52.xls	file = 934-C45.xls	file = 934-C46.xls	file = 934-C26.xls	file = 934-C16A.xls
	OAK-	OAK-	OAK-	OAK- (F4)-	OAK-	OAK-
	DICR SCOP-	DISC SCOP:	DISCR SCOP-	RHAC CAN-	MAHO AQU1	LONI HESP
	MONT PAR S.C.	TYPIC	SEDU SPA S.C.	SELA WAL S.C.	N=4	N=9
	N=7	N=4	N=5	N=4	PRES	PRES
	AV	AV	AV	AV	AV	AV
	COV	COV	COV	COV	COV	COV
	BEDROCK OUTCROPS					
OTHER COMMUNITIES						
TOTALS FOR THE PLANT COMMUNITIES:						
TOTAL COVER	1524.5	715	788.5	756	785	1773.5
DOMINANT COVER	887.5	359.5	269	386.5	394	668.5
DOM/TOT COV	0.5822	0.5028	0.3412	0.5112	0.5019	0.3769
TREE LAYER SPECIES WITH >= 0.70 IN AT LEAST ONE COMMUNITY						
QuergarA	0.5714 13.333	0.75 47.25	0 0	0.75 35	0.75 56	0.5556 52.222
QuergarB1	1 42.857	0.75 38.25	1 44	0.75 24.75	0.25 26.75	0.6667 23.667
QuergarB2	0.5714 8	1 7.625	1 31	0.75 6.125	1 9	0.8889 14.722
QuergarD	0.8571 2.8571	0.5 1.625	0.8 2.9	1 3.25	1 3.25	0.7728 3.5556
Pseumena	0.4286 5	0.25 4.5	0 0	0.75 10.5	0.25 4.5	0.6667 12.889
PseumenB1	0.1429 1	0 0	0.2 1.2	0.25 9.5	0.25 1.5	0 0
PseumenB2	0.1429 0.0833	0 0	0.2 1.2	0.25 4.5	0.25 4.5	0.1111 2
Pseumend	0.2857 0.1667	0.25 0.125	0 0	0.25 0.125	0 0	0.1111 0.0556
MEAN PRESENCE FOLLOWED BY COVER: SHADE PATTERNS ARE AS FOLLOWS:						
SPECIES WITH >= 0.70						
SPECIES WITH < 0.70						

Species designations consist of the first 4 letters of the genus followed by the first 3 letters of the species.

	file=934-C20.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls	file=934-C47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls
	OAK-	OAK-	OAK-	KRUM OAK-	OAK-	OAK-	OAK-	OAK-
	FEST IDA:	FEST IDA-	FEST IDA-	FEST IDA-	ELYM GLAV	BROM CAR	LATHNEV	CARE INOPS
TYPIC		CERA ARV S.C.	TRIE MCC S.C.	VICIA AME SC				
N=7	N=6	N=4	N=6	N=14	N=6	N=5	N=6	
PRES	PRES	PRES	PRES	PRES	PRES	PRES	PRES	PRES
AV	AV	AV	AV	AV	AV	AV	AV	AV
COV	COV	COV	COV	COV	COV	COV	COV	COV
Montpar	0	0	0	0	0	0	0	0
Aitrapra	0.4286 3.5	0.1667 0.0833	0.25 0.125	0.5 0.25	0.0714 0.0357	0.1667 0.0833	0	0.3333 1.0833
Ambedo	0.4286 1.7857	0.8333 11.417	0.5 6	0.5 7.4167	0.2857 0.9286	0.5 3.1667	0.4 8.8	0.5 5
Moatper	0.1429 0.8571	0.5 1.1667	0.25 0.125	0.3333 1.0833	0.3571 1.3571	0.5 4.0833	0	0
Polygly	0.1429 0.0714	0.1667 1	0	0	0.2143 0.5	0	0	0
Rhyrdi	0	0.1667 1	0	0.3333 4	0.2143 2.1429	0	0	0.1667 1
Broncar	0.7143 7.143	0.8333 11	0.75 0.375	0.8333 5.0833	0.5714 1.0714	1 2.8571	0.6 2.5	0.3333 4
Elyngla	0.8571 11.014	0.8333 10.083	1 1.875	0.6667 10	0.2857 2.8571	0.8333 2.25	0.2 3.6	0.8333 5
Galipa	0.8571 7	0.8333 6.25	0.75 6.125	1 5.1667	0.9286 5.1429	1 11.0833	0.6 8.4	0.8333 7
Sympalub B2	0.4286 1	0.5 2.0833	0	0.8333 10.5	0.6429 16.75	0.5 12.333	0.8 11.5	0.5 9.4167
Dierco	0.4286 6	0.5 5	0.5 3	0	0.0714 0.4286	0	0	0.6667 6
Lodumic	0.1429 2.5714	0.3333 3.0833	0.5 3	0.1667 0.0833	0.1429 0.4643	0	0	0.6667 3.0833
Rhacnan	0.1429 2.5714	0.1667 1	0.75 7.5	0.1667 1	0.1429 0.8571	0	0	0.5 3
Festidab	1 24.5714	1 17.543	0.75 21.5	0.8333 10.0833	0.4286 1.3929	0.3333 1.0833	0	0.6667 2.1667
Festbro	0.4286 6.3571	0.5 2.0833	0.5 1.625	0.5 2.0833	0.5 1.4286	0.8333 5.1667	0.8 9	0
Lonihis	0.7143 13.5714	0.5 5	0.5 6	0.6667 6.1667	0.3571 6.6071	0.3333 1.0833	0	0.3333 1.0833
Seduspa	0.2857 1.7143	0.1667 0.0833	0.25 0.125	0.3333 3.0833	0	0	0	0
Selawal	0.2857 0.9286	0.3333 3.0833	1 0.25	0.1667 0.0833	0.2143 0.1071	0.1667 0.0833	0	0
Luzamul	0.5714 3.5714	0.3333 1.0833	0.5 3	0.5 1.667	0.1429 0.4643	0	0.2 0.1	0.5 1.1667
Polyjun	0.2857 1.7143	0.1667 1	0	0	0	0	0	0
Collpar	0.1429 0.0714	0.3333 0.1667	0.25 0.125	0	0	0.1667 1	0	0.3333 2
Ciepis	0.1429 0.0714	0.1667 0.0833	0.25 0.125	0	0.1429 0.0714	0	0	0
Eriolan	0	0.3333 1.0833	0.25 0.125	0	0.2857 0.1429	0	0	0.1667 0.0833
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:								
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.								

	file = 934-C20.xls	file = 934-C25.xls	file = 934-C27.xls	file = 934-C42.xls	file = 934-C47.xls	file = 934-C43.xls	file = 934-C41.xls	file = 934-C14.X
	OAK-	OAK-	OAK-	KRUM OAK-	OAK-	OAK-	OAK-	OAK-
	FEST IDA-	FEST IDA-	FEST IDA-	FEST IDA-	ELYM GLAU	BROM CAR	LATHNEV	CARE DNOPS
	TRIF	CERA ARV S.C.	TRIF MCC S.C.	VICIA AME SC				
	N=7	N=6	n=4	N=6	N=14	N=6	N=5	N=6
	PRES	PRES	PRES	PRES	PRES	PRES	PRES	PRES
	AV	AV	AV	AV	AV	AV	AV	AV
	COV	COV	COV	COV	COV	COV	COV	COV
	HolodisB2	0.1429	0.0714	0.1667	1	0	0	0.3333
	HolodisB1	0.1429	2.5714	0	0	0.3333	6	0.2857
	CytisocB2	0.1429	0.0714	0.6667	8	0.25	4.5	0.5714
	Arennac	0.1429	0.0714	0	0	0	0	0.0714
	Steined	0.2857	0.1429	0.3333	0.1667	0.0833	0.3571	1.4286
	Erytore	0	0	0	0	0.25	0.2143	0.1071
	Fritlan	0.2857	0.1429	0.5	0.25	1.1667	0.1429	0.0714
	LonicilB1	0	0	0	0	0	0	0
	Lonicil	0	0	0	0.3333	0.1667	0	0
	RosannuB1	0	0	0	0	0	0	0
	Rosannu	0.1429	0.0714	0	0	0.3333	1.0833	0.0714
	Oenlicer	0	0	0	0	0	0.0714	0.0357
	OenlicerB2	0	0	0	0	0	0	0.1667
	Daphlau	0	0	0	0	0	0.2143	1.75
								0.1667
								0.0833
MEAN PRESENCE, FOLLOWED BY COVER FOR SHRUBS, HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST								
ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:								
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.								
TOTALS FOR THE PLANT COMMUNITIES:								
TOTAL COVER	1350.5	1151.5	822	1191	2827.5	1194	1287.5	1259
DOMINANT COVER	556	503.5	506.5	468	768	510.5	657.5	433
DOM/TOT COV	0.4117	0.4373	0.6162	0.3929	0.2716	0.4276	0.5107	0.3439

	file=934-20.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls	file=934-c47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls
OAK-	OAK-	OAK-	OAK-	KRUM OAK-	OAK-	OAK-	OAK-	OAK-
FEST IDA:	FEST IDA-	FEST IDA-	FEST IDA-	FEST IDA-	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS
TRIF	CERA ARV S.C.	TRIF MCC S.C.	VICIA AME SC	N=14	N=6	N=5	N=6	
N=7	N=6	N=4	N=6	N=14	N=6	N=5	N=6	
PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
COV	COV	COV	COV	COV	COV	COV	COV	COV
TREE LAYER SPECIES WITH > = 0.70 IN AT LEAST ONE COMMUNITY								
Quercus	0.4286	0.1667	0.5	0.3333	0.2857	0.1667	0.2	0.3333
QuercusB1	0.1429	0	0	0.1667	0.0714	0	0	0
QuercusB2	0.1429	0.1667	0.5	0.1667	0.1429	0	0	0.1667
QuercusD	0.2857	0.0833	0.75	0.0833	0.2857	0	0	0.0833
MEAN PRESENCE FOLLOWED BY COVER: SHADE PATTERNS ARE AS FOLLOWS:								
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.								
SPECIES WITH > = 0.70								

	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls				
	OAK-	OAK-	OAK-(FD)-	OAK-	OAK-	OAK-			
	MELI SUB	HOLO DISC-	HOLO DISC-	SYMPALB-	SYMPALB-	SYMPALB-			
		SYMPALB-	SYMPALB-	ROSA NUTK-	ROSA NUTK-	ROSA NUTK-			
		POLY GLYC	RHYT TRJ	LONI CL. S.C.	OEML CER S.C.				
	N=12	N=9	N=5	N=11	N=10				
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV				
	COV	COV	COV	COV	COV				
Montpar	0.0833 0.0417	0.1111 0.0556	0.2 0.1	0 0	0 0	0 0			
Aitapa	0.0833 0.0417	0.3333 1.3889	0 0	0 0	0.1 0.6				
Anthodo	0.25 3.0417	0.3333 4.3333	0.6 2.5	0.1818 1.6818	0 0	0 0			
Monper	0.25 3.6667	0.4444 2.0556	0.4 11.2	0.1818 1.6818	0.2 1.2	0 0			
Polyely	0 0	1 5.2222	0.4 1.3	0.2727 1.7273	0 0	0 0			
Rhytri	0.3333 5	0.1111 4.2222	1 23.6	0.1818 5.0909	0.2 6.9				
Bromcar	0.6667 4.1667	0.5556 15.3889	0.8 2.6	0.5455 1.2727	0.5 1.9				
Elymgla	1 5.7083	1 6.1111	0.8 1.5	0.8182 4.5	0.4 1.3				
Galapa	1 9.5417	0.7778 6.1111	1 6.2	0.8182 5.0909	0.6 3.05				
SympalB2	0.5 8.8333	0.6667 11.556	1 18.7	1 13.9419	1 12.5				
Diersco	0.25 1.5	0.7778 7.3333	0.4 2.4	0.0909 0.5455	0 0	0 0			
Latumic	0 0	0.1111 0.0556	0 0	0 0	0 0	0 0			
Rhaecan	0 0	0.6667 10.222	0.2 0.1	0 0	0 0	0 0			
Festidah	0.3333 1.5417	0.3333 1.3889	0 0	0 0	0 0	0 0			
Festbro	0.5833 2.6667	0.5556 1.5	0.4 1.3	0.0909 0.0455	0 0	0 0			
Lonthis	0.3333 5	0.2222 1.3333	0.4 2.4	0.4545 10.091	0 0	0 0			
Seduspa	0.0833 0.5	0.3333 0.1667	0.2 0.1	0.0909 0.0455	0 0	0 0			
Sclawal	0 0	0.1111 0.6667	0 0	0 0	0 0	0 0			
Luzumul	0.3333 0.1667	0.1111 0.0556	0.2 1.2	0.0909 0.0455	0 0	0 0			
Polyjun	0.0833 0.5	0.4444 6.2222	0.2 0.1	0 0	0 0	0 0			
Collpar	0.25 0.125	0.1111 0.0556	0 0	0.0909 0.0455	0 0	0 0			
Crepis	0 0	0 0	0 0	0 0	0 0	0 0			
Eriolan	0 0	0 0	0 0	0 0	0 0	0 0			
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE > = 0.70 IN AT LEAST									
ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:									
SPECIES BASED ON MEAN PRESENCE									
SPECIES WITH > 0.70									

Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.

	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls
	OAK-	OAK-	OAK- (FD)-	OAK-	OAK-
	MELI SUB	HOLO DISC- SYMPALB.	HOLO DISC- SYMPALB- RHYT TRI	SYMPALB- ROSA NUTK- LONI CIL S.C.	SYMPALB- ROSA NUTK- OEML CER S.C.
	N=12	N=9	N=5	N=11	N=10
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV
Plyun	0.0833 0.0417	0 0	0 0	0 0	0 0
Actimil	0.25 0.125	0.4444 0.8333	0.4 0.2	0.3636 0.6818	0 0
Runcece	0.25 0.125	0.5556 0.2778	0 0	0.1818 0.0909	0 0
Ceraarv	0.4167 0.6667	0.1111 0.0556	0.2 0.1	0.2727 0.1364	0 0
Saniera	0.625 0.625	0.2222 0.7222	0.4 0.2	0.4545 2.2273	0.4 1.3
Bromsie	0.5833 7.25	0.3333 0.7778	0.4 2.4	0.2727 0.6364	0.4 1.3
Cynocch	0.1667 2	0.2222 0.1111	0 0	0.1818 0.0909	0.1 0.05
MahoagUB2	0.5 2.5417	0.3333 3.3333	0.4 0.2	0.6364 3.9091	0.5 4.85
Vicisat	0.75 0.125	0 0	0.4 0.2	0.7273 2.8636	0.3 1.25
Viechit	0.6667 4.5417	0 0	0.6 3.8	0.4545 1.2273	0 0
Poa pra	0.9167 7.875	0.6667 0.3333	0.6 3.8	0.9091 4.5455	0.6 3.7
Hyporad	0.3333 0.1667	0.5556 0.8889	0.2 0.1	0.3636 0.1818	0.3 0.15
Trifolg	0 0	0 0	0 0	0 0	0 0
Trifmce	0.1667 0.5417	0 0	0.2 1.2	0 0	0 0
Almear	0.1667 0.0833	0.3333 0.7778	0.2 0.1	0 0	0 0
Carcino	0.4167 2.5833	0.3333 0.7778	1 2.7	0.0909 0.5455	0.1 0.05
Carnalei	0.5 2.625	0.8889 13.333	0.6 11.3	0.6364 4.5	0.5 3.65
Viciamc	0.25 1.0417	0.1111 0.6667	0.8 1.5	0.3636 1.6818	0.1 0.05
Daetglo	0.5 3.625	0.4444 6.0556	0.4 1.5	0.8182 10.773	0.6 3.59
Planlan	0.5 1.1667	0.1111 0.0556	0.2 0.1	0.4545 0.2273	0.1 0.6
Lathnev	0.25 0.5833	0.3333 0.7778	0.4 2.4	0.2727 4.5455	0.3 1.25
Ranuce	0.4167 1.125	0.1111 0.0556	0 0	0.1818 0.0909	0.1 1.8
Dantcal	0.25 0.125	0 0	0 0	0 0	0 0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS: SPECIES USED IN NODING SPECIES WITH >= 1.70

Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.

	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls			
	OAK-	OAK-	OAK-(FD)-	OAK-	OAK-	OAK-		
	MELI SUB	HOLO DISC-SYMPALB-	HOLO DISC-SYMPALB-	SYMPALB-ROSA NUTK-	SYMPALB-ROSA NUTK-	SYMPALB-ROSA NUTK-		
		POLY GLYC	RHYT TRI	LONI CIL S.C.	OEML CER S.C.			
	N=12	N=9	N=5	N=11	N=10			
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV			
	COV	COV	COV	COV	COV			
Melissub	0.25	0.2222	0.4	0.5455	0.2	0.65		
HolodisB2	0.3333	0.7778	0.6	0.4545	0.2	2.4		
HolodisB1	0.5833	0.2222	0.4	0.5455	0.5	8.6		
CytisobB2	0.25	0.7778	0.8	0.4545	0.2	0.1		
Arennac	0.25	0.1111	0.0556	0.1818	0.1	0.05		
Stelmed	0.5833	0.5556	1.5	0.0909	0.2	0.65		
Erytore	0.25	0.4444	1.4444	0.2727	0.4	1.85		
Fridan	0.1667	0.1111	0.0556	0.2727	0	0		
LonicilB1	0	0.1111	0.0556	0.2727	0	0		
Lonicil	0.1667	0.5417	0.6667	0.1636	0	0		
Rosanuib1	0	0	0	0.1636	0.5	13.9		
Rosanuib1	0.0833	0.5	0.3333	0.8182	0.9	22.45		
Oemlecr	0	0.1111	0.0556	0.3636	0.9	18.55		
OemlecrB2	0	0.2222	0.7222	0.2727	0.6	10.5		
Daphlau	0	0.2222	0.7222	0.4545	0.8	2.7		
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE > = 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:								
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.								
SPECS USED IN NAMING								
SPECS WITH > 0.70								
TOTALS FOR THE PLANT COMMUNITIES:								
TOTAL COVER	2350	1744.5	1275.5	2672	2324.5			
DOMINANT COVER	933.5	862.5	691	1259.5	1163.5			
DOM/TOT COV	0.3972	0.4944	0.5417	0.4714	0.5005			

	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls																
	OAK-	OAK-	OAK-(FD)-	OAK-	OAK-																
	MELI SUB	HOLO DISC-	HOLO DISC-	SYMPALB-	SYMPALB-																
		SYMPALB-	SYMPALB-	ROSA NUTK-	ROSA NUTK-																
		POLY GLYC	RHYT TRI	LONI CL S.C.	OEML CER S.C.																
	N=12	N=9	N=5	N=11	N=10																
	AV	AV	AV	AV	AV																
	COV	COV	COV	COV	COV																
TREE LAYER SPECIES WITH > = 0.70 IN AT LEAST ONE COMMUNITY																					
QuercusA	1.75 40.167	0.6667 29.222	1 45	1 58.445	1.8 53.4																
QuercusB1	1.667 30.167	0.8889 31.889	1 23.4	1.0889 22.182	0.7 21.2																
QuercusB2	0.75 15.167	0.7778 15.167	0.8 10.1	1.9889 10.545	0.6 5.15																
QuercusD	0.25 2.167	0.8889 1.0556	1 0.5	1.0564 0.4182	0.3 0.15																
PseumdenA	0.5 18.583	0.3333 5.5556	0.8 9.6	0.3636 6.1818	0 0																
PseumdenB1	0.25 2.5	0.1111 0.6667	0.2 1.2	0.2727 2.2773	0.1 0.6																
PseumdenB2	0.1667 1	0 0	0 0	0.0909 0.5455	0 0																
PseumdenD	0.25 0.125	0.1111 0.0556	0.2 0.1	0.2727 0.1364	0 0																
MEAN PRESENCE FOLLOWED BY COVER: SHADE PATTERNS ARE AS FOLLOWS:																					
SPECIES WITH >= 0.70																					
SPECIES WITH < 0.70																					

Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.

	file=934-c50.xls	file=934-c21.xls	file=934-c23.xls	file=934-c31a.xls	file=934-c29a.xls	file=934-c28b.xls	file=934-c28a.xls	file=934-c30.xls	file=934-c49.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
	RHAC CAN.	CYNO ECH	BROM STER	ANTHO ODOR	POA PRAT.	DACT GLOM.	DACT GLOM	DACT GLOM.	DACT GLOM.
	FEST BRON S.C.	LATE S.			VICSAT	BROM CAR S.C.	TYPIC	ARRH ELA S.C.	AGRO STO S.C.
	N=3	N=9	N=9	N=7	N=14	N=5	n=16	N=5	N=5
Charano	0.5667	0	0	0	0	0	0	0	0
Achmil	0.5667	0.3333	0.5556	0.429	0.357	0.4	0.25	0	0.2
Brommol	0.5667	0.4444	0.5556	0.429	0.643	0.6	0.438	0.3333	0
Rumace	0.5667	0.5556	0.2222	0.286	0.286	0.2	0.313	0	0.2
Airagra	0.5667	0.1111	0.6667	0.571	0.143	0	0.125	0	0.2
Brodcor	0.5667	0.4444	0.3333	0.286	0.357	0	0.313	0.1667	0.4
Luzumil	0.5667	0	0.1111	0.286	0.214	0	0.25	0	0.4
Carcino	0.5667	0.3333	0	0.429	0.214	0	0.438	0	0
Lomilis	0.5667	0.2222	2.0556	0.429	0.357	0.2	0.313	0	0
Tritari	0.5667	0.1111	0.0556	0	0	0	0	0	0
Polyun	0.5667	0.1111	0.6667	0.286	0	0	0.125	0	0
Cermary	0.5667	0.3333	0.7778	0.286	0.5	0.2	0.438	0.1667	0
Lotumic	0.5667	0.2727	0.9133	0	0.429	0	0.125	0	0.2
Cynocch	0.5667	0.5	0.3333	0.286	0.357	0.2	0.375	0	0
Rhacean	0.5667	0.5556	0.2222	0.571	0	0	0.125	0.1667	0
Trifmoc	0.5667	0.5667	0.1111	0.143	0.357	0	0.063	0	0
Fesbrod	0.5667	0.3333	4.0556	0.571	0.714	0.6	0.438	0.3333	0.2
Hypernd	0.5667	0.3333	0.1667	0.444	0.571	0.9	0.438	0.5	0.2
Elympla	0.5667	0.5667	6.7778	0.714	0.429	0.9	0.438	0	0.4

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST

ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:

Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.

	File=934-C50.xls	File=934-C21.xls	File=934-C23.xls	File=934-C31a.xls	File=934-C29a.xls	File=934-C28b.xls	File=934-C28a.xls	File=934-C30.xls	File=934-C49.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
	RHAC CAN-	CYNO BCH	BROM STER	ANTHO ODOR	POA PRAT-	DACT GLOM-	DACT GLOM	DACT GLOM-	DACT GLOM-
	PEST BROM S.C.	LATE S.			VICISAT	BROM CAR S.C.	TYPIC	ARRH ELA S.C.	AGRO STO S.C.
	N=3	N=9	N=9	N=7	N=14	N=5	N=16	N=5	N=5
Bromear	2.2333	0.2222	0.1111	0.6667	0.429	1	0.76	0.6667	7.0833
Bromate	0.6667	0.3333	0.3333	0.429	0.214	0.6	0.563	0.6667	0.4
Vicibir	0.6667	0.3333	0.2222	0.571	0.857	9.7	0.75	0.3333	0.4
Poa pra	0.6667	0.3333	0.2222	0.571	0.857	10	0.688	0.3333	0.6
Sanicra	0.6667	0.3333	0.2222	0.714	0.929	2.6	0.875	0.6667	0.6
Viciset	0.6667	0.3333	0.2222	0.714	0.929	2.6	0.875	0.6667	0.6
Gallega	0.3333	0.1667	0.6667	0.714	0.929	2.6	0.875	0.6667	0.6
Plantan	0.3333	0.1667	0.2222	0.1111	0.6667	0.6	0.5	0.5	0.6
Ranuooc	0	0	0.2222	0.1111	0.6667	0.6	0.375	0.1667	0.2
Aulibodo	0.3333	2	0.3333	0.3333	0.2778	1.2	0.375	0.1667	0.2
Dancal	0.3333	2	0.4444	0.3333	0.0556	4.8	0.5	0.1667	0.6
Tridub	0.3333	0.1667	0.4444	0.4444	0.0556	0	0.188	0	0.2
Sympn1B2	0.3333	0.1667	0.4444	0.4444	0.0556	1.4	0.188	0.5	0
Daeglo	0	0	0.2222	0.1111	0.3333	8.8	0.75	0.5	0.6
Geranol	0	0	0.6667	0.3333	0.429	0.3	0.75	0.3333	0.6
Camalet	0.3333	0.1667	0	0.4444	0.286	7.4	0.563	0.3333	0.6
Artichla	0	0	0	0	0.071	0	0	0.3333	0.4
Agrosu	0	0	0	0	0.143	1.2	0.063	0	1.2
Tarnoff	0	0	0	0.1111	0.286	1.3	0.438	0.5	0.8

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:

Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.

	file=934-C30.xls	file=934-C21.xls	file=934-C23.xls	file=934-C31a.xls	file=934-C29a.xls	file=934-C28b.xls	file=934-C28a.xls	file=934-C30.xls	file=934-C49.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	
	RHAC CAN-	CYNO ECH	BROM STER	ANTHO ODOR	POA PRAT-	DACT GL.OM.	DACT GL.OM	DACT GL.OM.	DACT GL.OM.
	PEST BROM S.C.	LATB S.			VICISAT	BROM CAR S.C.	TRYPIC	ARRH ELA S.C.	AGRO STO S.C.
	N=3	N=9	N=9	N=7	N=14	N=5	n=16	N=5	N=5
TOTALS FOR THE PLANT COMMUNITIES:									
TOTAL COVER	382	1912	1924	1649	3075	1124.5	3278	1267.5	971
DOMINANT COVER	523	922	859.5	803.5	1427	718	1480	657.5	333
DOM/TOT COV	0.8986	0.4822	0.4467	0.487	0.464	0.6385	0.451	0.5187	0.3429
TREE LAYER SPECIES WITH > = 0.70 IN AT LEAST ONE COMMUNITY									
QuercusP1	0.6667 18.667	1 66.333	0.6667 28.889	1.000 33.333	0.7273 22.727	0.7273 22.727	0.7273 22.727	0.7273 22.727	0.7273 22.727
QuercusP2	0.6667 27	0.4444 5.222	0.7778 28.889	0.250 8.333	0.7273 22.727	0.7273 22.727	0.7273 22.727	0.7273 22.727	0.7273 22.727
QuercusP3	1 18.667	0.7778 10.111	0.7778 28.889	0.250 8.333	0.7273 22.727	0.7273 22.727	0.7273 22.727	0.7273 22.727	0.7273 22.727
QuercusP4	0.6667 4	0.3333 0.6667	0.6667 4.7778	0.250 1.250	0.7273 2.2727	0.7273 2.2727	0.7273 2.2727	0.7273 2.2727	0.7273 2.2727
PecunnaA	0.6667 8	0.3333 6.8889	0 0	0.286 3.429	0.214 3	0 0	0.25 3	0 0	0 0
PecunnaB1	0.3333 2	0.1111 0.6667	0 0	0.286 1.714	0.071 0.429	0.2 7.6	0.125 0.75	0 0	0 0
PecunnaB2	0.3333 6	0 0	0.1111 2	0.143 0.857	0 0	0.1 0.1	0 0	0 0	0 0
PecunnaD	0.3333 0.1667	0.1111 0.0556	0 0	0 0	0 0	0.4 0.2	0 0	0 0	0 0
MEAN PRESENCE FOLLOWED BY COVER SHADE PATTERNS ARE AS FOLLOWS:									
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.									

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.
Althea	0.3333	4.1	0.3333	2	0	0	0	0
Cynoch	0.1667	0.7	0.3333	12.667	0.25	1.5	0	0
Escabo	19.75	50.8	0	0	0.25	4.8	0.6667	4.6667
Cytisob1	0.1	5.6	0.3333	0.1667	4	4	0.3333	4
Cytisob2	0.3	24.2	14	14	37.5	18	4	4
Bromac	0.8333	6.0833	0.9	7.5	20	20	0.6667	6.6667
Elymgl	0.8333	3.1667	0.8	5.45	0.75	3.125	2.3333	2.3333
Galapa	0.3333	2.65	0.7	2.65	0.75	4.75	0.6667	6.1667
Santora	0.3333	1.9	0.3333	0.1667	0.25	1.5	1	4.1667
Atripira	0.1667	0.0833	0.9	7.25	0.75	7.5	0.4	0.2
Braunol	0.6667	3.0833	0.7	4.85	1	14.25	0.6667	6.1667
Rhescan	0.6667	11.333	0.9	28	1	43.75	0.6667	8
Rumscac	0.5	1.667	1	1.5	0.5	3	0.3333	0.1667
Polijun	0	0	0.6667	4	0.5	3	0	0
Sciawal	0.3333	0.1667	0.5	0.25	0.5	0.25	0.3333	2
Lotumic	0.6667	0.3333	0.2	0.1	0.75	3.125	0	0
Brodcor	0.5	1.1667	0.6	4.35	0.75	4.75	0.3333	2
Bromiee	0.1667	3	0.3	1.25	1	1.25	0	0
MahoaquB2	0.3333	1.0833	0	0	0.25	1.25	0.6667	12
Luzumul	0.3333	0.1667	0.1	0.6	0	0	0.6667	12
Anthodo	0.1667	0.0833	0.2	1.2	0.5	0.25	0.6667	4.1667
Colpar	0.3333	0.1667	0.3	0.15	0.5	0.25	0.6667	4.1667
Camueli	0.6667	4.1667	0.6	3.7	0.5	1.625	0.3333	6

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:

Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.

Species	file=934-C1.xls	file=934-C3.xls	file=934-C17.xls	file=934-C22.xls	file=934-C31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
OAK-		O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
BROOM-		RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
CYNO ECH		FEST BROM-	RHAC CAN:	BROM TEC	ANTHO ODOR	POA PRAT	DACT OLOM	EL YM CLAU
LATE S.		AIRA S.C.	TYPIC S.C.	S.C.				
N=6		N=10	N=3	N=4	N=3	N=5	N=5	N=6
Stelmed	0.1667 3	0.4	0.2	0.25	0.125	0.6667 0.3333	0.8	0.6
Vetrost	0.1667 0.0833	0.3	0.15	0.5	0.25	0.6667 0.3333	0.8	0.6
Sympalhb2	0.1667 0.0833	0	0	0.5	1.625	0.6667 0.3333	0.8	0.6
Viciset	0.5	2.0833	0.5	2.55	0.75	0.6667 0.3333	0.8	0.6
Trifur	0	0	0.2	0.1	0.25	0.6667 0.3333	0.8	0.6
Myosais	0.5	0.25	0.4	0.2	1.5	0.6667 0.3333	0.8	0.6
Hypond	0.5	0.25	0.4	0.2	0.25	0.6667 0.3333	0.8	0.6
Daphlau	0.1667 0.0833	0	0	0	0	0.6667 0.3333	0.8	0.6
Picecan	0	0	0	0	0.25	0.6667 0.3333	0.8	0.6
Rhyurt	0.1667 10.5	0	0	0.25	1.5	0.6667 0.3333	0.8	0.6
Dodehen	0.5	2.0833	0.2	0.1	0	0.6667 0.3333	0.8	0.6
Lonobia	0.1667 1	0	0	0.5	1.625	0.6667 0.3333	0.8	0.6
Gallapa2	0	0	0	0	0	0.6667 0.3333	0.8	0.6
Teesrud	0.3333 0.1667	0.1	0.05	0	0	0.6667 0.3333	0.8	0.6
Sielat	0.1667 0.0833	0.2	0.1	0	0	0.6667 0.3333	0.8	0.6
Melisaub	0.5	4.0833	0.1	0.6	0	0.6667 0.3333	0.8	0.6
Geramol	0.5	4.0833	0.5	0.8	1.625	0.6667 0.3333	0.8	0.6
Eurhore	0.1667 3	0.1	1.8	0.5	3	0.6667 0.3333	0.8	0.6
Bromcar	0.5	1.1667	0.3	1.8	0.125	0.6667 0.3333	0.8	0.6
Dactilo	0.3333 1.0833	0.2	0.65	0	0	0.6667 0.3333	0.8	0.6
Poa pra	0.3333 3.0833	0.6	1.95	0	0	0.6667 0.3333	0.8	0.6
Montper	0.5	1.1667	0.2	1.85	1.625	0.6667 0.3333	0.8	0.6
Planlan	0	0	0.1	0.05	0	0.6667 0.3333	0.8	0.6
Viehrir	0.6667 6.1667	0.4	0.2	0.5	1.625	0.6667 0.3333	0.8	0.6

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:

Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.

	file=934-C2.xls	file=934-C3.xls	file=934-C17.xls	file=934-C22.xls	file=934-C31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
OAK-		O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
BROOM-		RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
CYNO ECH		FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODO	POA PRAT	DACT GLOM	EL YM GLAU
LATE S.		AIRA S.C.	TYPIC S.C.	S.C.				
N=6		N=10	N=3	N=4	N=3	N=5	N=5	N=6
Osmochl	0.1667	1	0	0	0	0.2	0.1	0.1667
Ncanpar	0.1667	0.0833	0.1	0.05	0	0.6	2.5	0.5
Polymun	0.3333	0.1667	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES WITH A PRESENCE >= 0.70 IN AT LEAST ONE COMMUNITY. SHADE PATTERNS ARE AS FOLLOWS:								
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.								
TOTALS FOR THE PLANT COMMUNITIES:								
TOTAL COVER	1488	1878	606	936.5	817	1212	1377	1228.5
DOMINANT COVER	886.5	1404	430	715.5	676	861	887.5	653.5
DOM/TOT COV	0.5958	0.7476	0.7096	0.764	0.8274	0.7104	0.6445	0.5319
TREE LAYER SPECIES WITH >= 0.70 IN AT LEAST ONE COMMUNITY								
Quercus	2.5667	20.333	0.5	0.5	0.3333	0.4	2.5	1
Quercus	0.8333	13.333	0.7	21.5	1	0.3	2.5	0.4
Quercus	0.6667	5	0.7	7.9	1	0.3	0.1	0.5
Quercus	0.3333	0.1667	1	0.6667	4	0.3333	0.3	0.3
PanicumA	0.1667	6.3333	0	0	0.25	4.5	0.6	6
PanicumB1	0.1667	1	0	0	0	0.2	1.2	0
PanicumB2	0.1667	0.0833	0.1	0.05	0	0	0.2	1.2
PanicumD	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER. SHADE PATTERNS ARE AS FOLLOWS:								
Species are designated by the first 4 letters of the genus followed by the first 3 letters of the species.								

APPENDIX 9 PHOTOGRAPHS OF PLANT COMMUNITIES

(Some communities are missing because my photos of them were not suitable)

c37a Oak - *Camassia quamash*: Typic subcommunity
Landscape - Juan de Fuca Recreation Centre, 93R JDF03



c35a Oak- *Camassia quamash*- *Erythronium oregonum* subcommunity
plant community: Saint Peter's Church, 93R SP01



c35b Oak - *Camassia quamash* - *Dodecatheon hendersonii* subcommunity
plant community: Priest Point, 93R PP01



c37b Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity
Stand: Uplands, 93R UP05



c37b Oak - *Camassia quamash* - *Ranunculus occidentalis* subcommunity
plant community: Summit Park, 94R SU01B



c36 Oak - *Camassia leichtlinii*
Stand: University of Victoria, 94R UV02



c36 Oak - *Camassia leichtlinii*
plant community: Knockan Hill, 94R KH01B



c51 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity
plant community: Thetis Lake Park, 94R TH04



c51 Oak - *Dicranum scoparium* - *Plectritis congesta* subcommunity
stand: Thetis Lake Park, 94R TH04



c11 Oak - *Dicranum scoparium* - *Montia parvifolia* subcommunity
Stand: Harewood Plains, 94R HA02



c11 Oak - *Dicranum scoparium* - *Montia parvifolia* subcommunity
plant community: Harewood Plains, 94R HA02



c45 Oak - *Dicranum scoparium* - *Sedum spathulifolium* subcommunity
Stand: Jack Point, 94R JP01



c45 Oak - *Dicranum scoparium* - *Sedum spathulifolium* subcommunity
plant community: Jack Point, 94R JP01



c52 Oak- *Dicranum scoparium*: Typic subcommunity
plant community: Jack Point, 94R JP02



c52 Oak- *Dicranum scoparium*: Typic subcommunity
stand: Jack Point, 94R JP02



c46 Oak - (Fd) - *Rhacomitrium canescens* - *Selaginella wallacei*
subcommunity Stand: Mt. Parke, 94R MN02



c46 Oak - (Fd) - *Rhacomitrium canescens* - *Selaginella wallacei*
subcommunity plant community: Mt. Parke, 94R MN02



c26 Oak - *Mahonia aquifolium*
Stand: Observatory Hill, 94R OH05



c26 Oak - *Mahonia aquifolium*
plant community: Observatory Hill, 94R OH05



c16a Oak - *Lonicera hispidula* (colluvial)
Stand: Nanoose Hill, 93R NH06



c16a Oak - *Lonicera hispidula* (colluvial)
plant community: Nanoose Hill, 93R NH06



c20 Oak - *Festuca idahoensis* Typic subcommunity
Stand: Rocky Point, 94R RP07



c20 Oak - *Festuca idahoensis* Typic subcommunity
plant community: Rocky Point, 94R RP07



c25 Oak - *Festuca idahoensis* - *Cerastium arvense* subcommunity
Stand: Rocky Point, 94R RP06



c25 Oak - *Festuca idahoensis* - *Cerastium arvense* subcommunity
plant community: Rocky Point, 94R RP06



c27 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity
Stand/ landscape: Mt. Warburton-Pike, 93R SA04



c27 Oak - *Festuca idahoensis* - *Trifolium microcephalum* subcommunity
plant community/stand: Portland Island



c42 Krummholz Oak - *Festuca idahoensis* - *Vicia americana* subcommunity
Stand: Flewitt Point, 94R YE05



c42 Krummholz Oak - *Festuca idahoensis* - *Vicia americana* subcommunity
plant community: Flewitt Point, 94R YE05



c47 Oak - *Elymus glaucus*
Stand/landscape, 94R LTH04



c47 Oak - *Elymus glaucus*
plant community, Lone Tree Hill, 94R LTH04



c41 Oak - *Lathyrus nevadensis*
Stand: Beacon Hill Park, 94R BHP04



c41 Oak - *Lathyrus nevadensis*
plant community: Beacon Hill Park, 94R BHP04



c43 Oak - *Bromus carinatus*
Stand: Rocky Point, 94R RP04



c43 Oak - *Bromus carinatus*
plant community: Rocky Point, 94R RP04



c14 Oak - *Carex inops*
Stand/ landscape: Nanoose Hill, 93R NH04



c14 Oak - *Carex inops*
plant community: Nanoose Hill, 93R NH04



c13 Oak - *Melica subulata*
Stand: Rocky Point, 94R RP05



c13 Oak - *Melica subulata*
plant community: Rocky Point, 94R RP05



c15 Oak - *Holodiscus discolor* - *Symphoricarpos albus* - *Polypodium glycyrrhiza*
plant community: Mt. Doug, 93R MD05



c10 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidiadephus triquetris*
Stand/plant community: Thetis Lk. Park, 94R TH06



c10 Oak - (Fd) - *Holodiscus discolor* - *Symphoricarpos albus* - *Rhytidadelphus triquetris*
plant community: Mt Finlayson, 93R MF02



c8 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity
(thickets) Stand/ plant community: Uplands Park, 93R UP09



c8 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Lonicera ciliosa* subcommunity
(thickets) plant community: Uplands Park, 93R UP09



c9 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity
(thickets) Stand: University of Victoria, 94R UV01



c9 Oak - *Symphoricarpos albus* - *Rosa nutkana* - *Oemleria cerasiformis* subcommunity
(thickets) plant community: University of Victoria, 94R UV01



c50 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity
Stand/ landscape: Mt. Galiano, 94R GALI16



c50 Oak - *Rhacomitrium canescens* - *Festuca bromoides* subcommunity
plant community: Water Tower Hill, 94R BN07



c21 Oak - *Cynosurus echinatus* (late season)
Stand/ landscape: Yellow Point, 94R YE01



c21 Oak - *Cynosurus echinatus* (late season)
plant community: Yellow Point, 94R YE01



c23 Oak - *Bromus sterilis*
Stand/ landscape: Observatory Hill, 94R OH06



c23 Oak - *Bromus sterilis*
plant community: Observatory Hill, 94R OH06



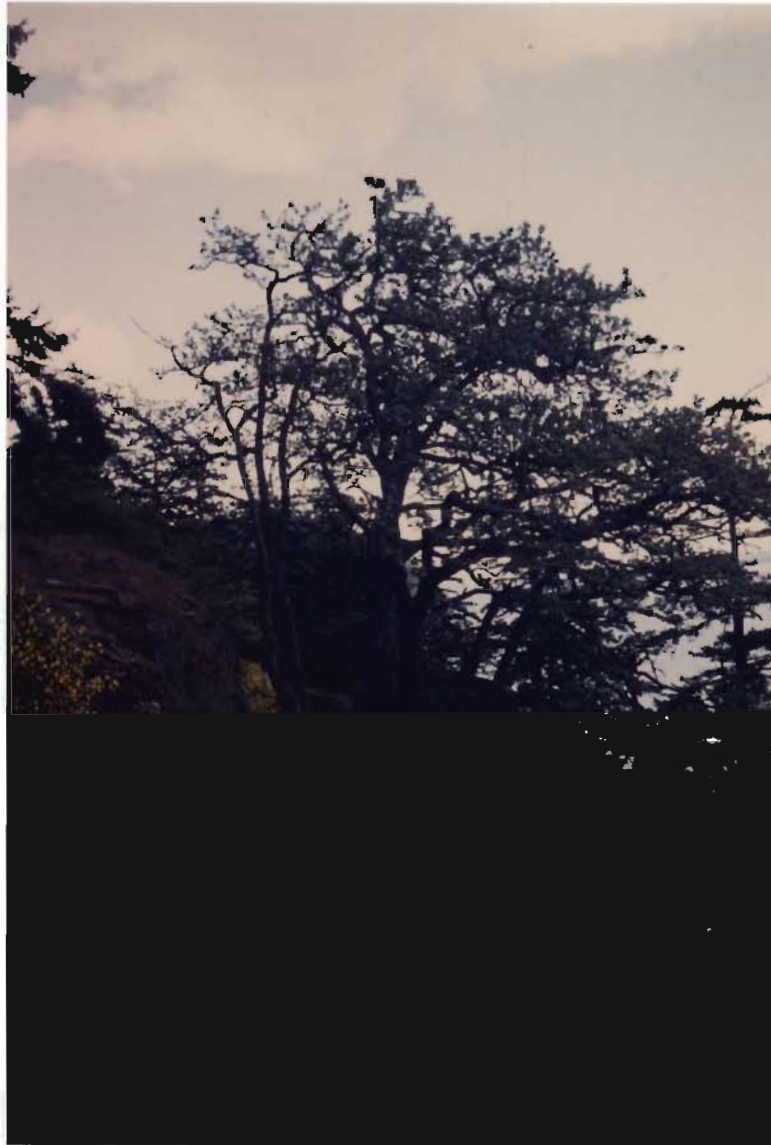
c31a Oak - *Anthoxanthum odoratum*
Stand: Water Tower Hill, 94R BN10



c31a Oak - *Anthoxanthum odoratum*
plant community: Water Tower Hill, 94R BN10



c29a Oak - *Poa pratensis* - *Vicia sativa*
Stand/ landscape: Elliott Bluff, 94R PE01



c29a Oak - *Poa pratensis* - *Vicia sativa*
plant community: Elliott Bluff, 94R PE01



c28a Oak - *Dactylis glomerata* Typic subcommunity
Stand: Elliott Bluff, 94R PE02



c28a Oak - *Dactylis glomerata* Typic subcommunity
plant community: Elliott Bluff, 94R PE02



c28b Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity
Stand: Gowlland Point, 94R PE10



c28b Oak - *Dactylis glomerata* - *Bromus carinatus* subcommunity
plant community: Gowlland Point, 94R PE10



c30 Oak - *Dactylis glomerata* - *Arrhenatherum elatius* subcommunity
Stand/ plant community: Panama Hill, 94R PA02



c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity
Stand: Rocky Point, 94R RP03



c49 Oak - *Dactylis glomerata* - *Agrostis stolonifera* subcommunity
plant community: Glendale Lands, 94R GLA07



c3 Oak - Broom - *Rhacomitrium canescens* - *Festuca bromoides* - *Aira*
subcommunity Stand: Observatory Hill, 94R OH04



c3 Oak - Broom - *Rhacomitrium canescens* - *Festuca bromoides* - *Aira*
subcommunity plant community: Observatory Hill, 94R OH04



c17 Oak - Broom - *Rhacomitrium canescens*: Typic subcommunity
plant community: Songhees, 93R SG01



c22 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum*
subcommunity Stand: Water Tower Hill, 94R BN08



c22 Oak - Broom - *Rhacomitrium canescens* - *Bromus tectorum*
subcommunity plant community: Water Tower Hill, 94R BN08



c2 Oak - Broom - *Cynosurus echinatus* (late season)
Stand: Observatory Hill, 93R OH01



c2 Oak - Broom - *Cynosurus echinatus* (late season)
plant community: Observatory Hill, 93R OH01



c6 Oak - Broom - *Elymus glaucus*
Stand: Observatory Hill: 93R OH03



c6 Oak - Broom - *Elymus glaucus*
plant community: Observatory Hill: 93R OH03



c4 Oak - Broom - *Poa pratensis*
Stand: Thetis Lake Park, 94R TH03



c4 Oak - Broom - *Poa pratensis*
plant community: Thetis Lake Park, 94R TH03



c5 Oak - Broom - *Dactylis glomerata*
Stand: Oak Bluffs, 94R PE11



c5 Oak - Broom - *Dactylis glomerata*
plant community: Lester Pearson College, 93R LP02



	file=934-C51.xls		FILE=934.C35B.		file=934-C37A.		file=934-C37B.xl		file=934-C35A.xls		file=934-c36.xls		file=934-c48.	
	OAK-		OAK-		OAK-		OAK-		OAK-		OAK-		OAK-	
	DICR SCOP-		CAMA QUA-		CAMA QUA-		CAMA QUA-		CAMA QUA-		CAMA LBI		MONT PER	
	PLECT CON S.C		DODE HEN S.C.		TYPIC		RANU OCC S.C.		ERYTH ORE S.C.					
	n=3		n=4		N=12		n=6		N=5		N=50		N=12	
	PRES	AV	PRES	AV	PRES	AV	PRES	AV	PRES	AV	PRES	AV	PRES	AV
		COV		COV		COV		COV		COV		COV		COV
Poa sec	0	0	0	0	0	0	0	0	0	0	0.02	0.01	0	0
Pohlnut	0.333	2	0	0	0	0	0	0	0	0	0	0	0	0
Polygonu	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polymun2	0	0	0	0	0	0	0.167	1	0	0	0	0	0	0
Polypil	0	0	0	0	0	0	0	0	0	0	0.02	0.12	0	0
Polyspe	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potegla	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prusvul	0	0	0	0	0	0	0	0	0	0	0.02	0.12	0	0
Ptoragu	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ranurep	0	0	0	0	0	0	0.333	0.167	0	0	0	0	0	0
Rhachet	0	0	0	0	0	0	0	0	0	0	0.02	0.36	0	0
Rhincri	0	0	0.5	3	0.333	1.083	0	0	0	0	0.04	0.24	0	0
Rumecosa	0	0	0	0	0	0	0	0	0	0	0.06	0.03	0	0
Sanicul	0	0	0	0	0.083	0.042	0	0	0	0	0	0	0	0
Sanigra	0	0	0	0	0.083	0.042	0	0	0.2	0.1	0	0	0	0
Satudou	0	0	0.5	1.625	0.167	0.542	0	0	0.2	0.1	0.12	0.76	0.083	0.0417
Saxilint	0	0	0	0	0	0	0	0	0	0	0.04	0.02	0	0
Sedulun	0	0	0.5	0.25	0	0	0.167	0.083	0	0	0.04	0.02	0.083	0.0417
Sedum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senecind	0	0	0	0	0	0	0	0	0	0	0.02	0.01	0	0
Senecvul	0	0	0	0	0	0	0	0	0	0	0	0	0.083	0.0417
Sisydou	0	0	0	0	0	0	0.167	0.083	0	0	0.06	0.25	0.083	0.0417
Smilste	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solanig	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soncarv	0	0	0	0	0	0	0	0	0	0	0.04	0.02	0	0
Stipleem	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thalocc	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tortur	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tragpar	0	0	0	0	0	0	0	0	0.2	1.2	0	0	0	0
Triclat	0.333	0.167	0	0	0	0	0	0	0	0	0	0	0	0
Trifdep	0	0	0	0	0	0	0.167	1	0	0	0	0	0	0
Triflyb	0	0	0	0	0	0	0	0	0.2	1.2	0.04	0.13	0	0
Trifmic	0	0	0	0	0	0	0	0	0.2	0.1	0.02	0.01	0	0
Trifoli	0	0	0.25	0.125	0.167	1	0.333	2	0	0	0.02	0.12	0	0
Trifrep	0	0	0	0	0	0	0.167	0.083	0	0	0.02	0.12	0	0
Trifrub	0	0	0	0	0	0	0	0	0	0	0.06	0.73	0	0
Trifvar	0	0	0.25	0.125	0	0	0	0	0	0	0	0	0	0
Tritaes	0	0	0	0	0	0	0	0	0	0	0.02	0.01	0	0
Trithya	0	0	0	0	0	0	0	0	0	0	0.24	0.23	0.167	0.0833
Veroame	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Veroaic	0	0	0	0	0.083	0.042	0	0	0	0	0	0	0	0
Vicia	0	0	0.25	0.125	0	0	0	0	0	0	0	0	0	0
Viciera	0	0	0	0	0	0	0.167	3	0	0	0.04	0.13	0	0
Vincemin	0	0	0	0	0	0	0	0	0.2	0.1	0	0	0	0
Violpra	0	0	0	0	0.083	0.042	0	0	0	0	0	0	0	0
Zigaven	0	0	0	0	0.25	1.042	0.333	2	0	0	0.04	0.02	0.083	0.0417

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSSLAYER SPECIES
 Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

APPENDIX 10 (2) FULL TABLE OF NATIVE PLANT COMMUNITIES (1)

	file=934-C11.xls	file=934-C32.xls	file=934-C35.xls	file=934-C46.xls	file=934-C26.xls	file=934-C16A.xls	file=934-420.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls
	OAK-	OAK-	OAK-	OAK-(Tb)-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
	DICR SCOP-	DISC SCOP-	DISCR SCOP-	RHAC CAN-	MAHO AOUT	LOMT HSP	FEST IDA-	FEST IDA-	FEST IDA-	FEST IDA-
	MONT PAR S.C.	TYPIC	SEDU SPA S.C.	SELA WAL S.C.			TYPIC	CERA ARV S.C.	TRIF MCC S.C.	VICIA AME
	N=7	N=4	N=5	N=4	N=4	N=9	N=7	N=6	N=4	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV	COV
NATIVE PLANT COMMUNITIES OF HERBACEOUS OUTCROPS										
OTHER NATIVE PLANT COMMUNITIES										
Abiegrad	0	0	0	0	0	0	0	0	0	0
AcerraA	0	0	0	0	0	0	0	0	0	0
AcerraB1	0	0.25	4.5	0	0	0	0	0	0	0
AcerraB2	0	0	0	0	0	0	0	0	0	0
AcerraD	0.286	1.083	0.5	1.625	0.25	0.125	0.222	0.111	0	0
ArburnaA	0.143	3	0	0	0	0	0.143	0.857	0	0
ArburnaB1	0	0	0	0	0	0.222	1.333	0.143	2.571	0
ArburnaB2	0	0	0	0	0	0	0	0.167	0.083	0
ArburnaD	0	0	0	0	0	0	0.429	0.214	0	0
JuniscoA	0	0	0	0	0	0	0	0	0	0
JuniscoB1	0	0	0.2	1.2	0	0	0.143	5.429	0	0
JuniscoB2	0	0	0	0	0	0	0	0	0	0
PinuponaB1	0	0	0	0	0	0	0	0	0	0
AmclalB1	0	0	0	0	0	0	0.143	0.857	0	0
AmclalB2	0.143	0.083	0.25	4.5	0.25	0.125	0.286	0.929	0	0.5
Cytiscob1	0	0	0	0	0	0.111	4.222	0	0.167	1
HedebelEP	0	0	0	0	0	0	0	0	0	0
HedebelD1	0	0	0	0	0	0	0	0	0	0
HedebelB2	0	0	0	0	0	0	0	0	0	0
LonhisB1	0	0	0	0	0	0.111	0.056	0	0	0
Ruburs	0	0	0.25	0.125	0.2	0.1	0.286	0.143	0	0
Arcecol	0	0	0	0	0	0	0	0	0	0
Arcecol	0	0	0	0	0.2	0.1	0.143	0.071	0	0
ComstrB1	0	0	0	0	0	0	0	0	0	0
ComstrB2	0	0	0	0	0	0	0	0	0	0
Crataegu	0	0	0	0	0	0	0	0	0.25	0.125
CratdouB1	0	0	0	0	0	0	0	0	0	0
CratdouB2	0	0	0	0	0	0	0	0	0	0
CratmonB1	0	0	0	0	0	0	0	0	0	0
CratmonB2	0	0	0	0	0	0	0	0	0	0
Gaulsha	0	0	0	0	0	0	0	0	0	0
Gaulsha	0	0	0	0	0	0	0	0	0	0
FlexeurB2	0	0	0	0	0	0	0	0	0	0
LychalB2	0	0	0	0	0	0	0	0	0	0
Mahaqub1	0	0	0	0	0	0	0	0	0	0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS, HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

APPENDIX 10 (2) FULL TABLE OF NATIVE PLANT COMMUNITIES (1)

	file=934-C11.xls	file=934-C52.xls	file=934-C45.xls	file=934-C46.xls	file=934-C26.xls	file=934-C16A.x	file=934-20.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls
	OAK-	OAK-	OAK-	OAK-(FD)	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
	DISCR SCOP-	DISC SCOP:	DISCR SCOP-	RHAC CAN-	MARO AQUI	LOMI HISP	FEST IDA:	FEST IDA-	FEST IDA-	FEST IDA-
	MONT PAR S.C.	TRYPIC	SEDU SPA S.C.	SELA WAL S.C.				CERA ARV S.C.	TRIF MCC S.C.	VICIA AME
	N=7	N=4	N=5	N=4	N=4	N=9	N=7	N=6	N=4	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV	COV
	NATIVE PLANT COMMUNITIES OF BEDROCK OUTCROPS									
	OTHER NATIVE PLANT COMMUNITIES									
Malonet	0	0	0	0	0	0.111	0.056	0	0	0
Malus	0	0	0	0	0	0	0	0	0	0
Cotoneas	0	0	0	0	0	0	0	0	0	0
Paxtanyr	0.143	0.083	0.25	1.5	0.6	2.5	0.5	0.25	0	0.333
Phillewb1	0	0	0	0	0	0	0	0	0	0
Phillewb2	0	0	0	0	0	0	0	0	0	0
Physcamb1	0	0	0	0	0	0	0	0	0	0
Physcamb2	0	0	0	0	0	0	0	0	0	0
Pruncamb1	0	0	0	0	0	0	0	0	0	0
Pruncamb2	0	0	0	0	0	0	0	0	0	0
Prunab1	0	0	0	0	0	0	0	0	0	0
Prunab2	0	0	0	0	0	0	0	0	0	0
Prunvirb2	0	0	0	0	0	0.111	4.222	0	0	0
Rhampurb1	0	0	0	0	0	0	0	0	0	0
Rhampur	0	0	0	0	0	0	0	0	0	0
Rosa	0	0	0	0.2	1.2	0	0	0	0	0
Rosegym	0.429	2.083	0	0	0	0.111	0.667	0.143	0.857	0
Rosapris	0	0	0	0	0	0	0	0	0	0
Rubupro	0.143	0.083	0	0.2	0.1	0	0	0	0.167	0.083
RubuproB1	0	0	0	0	0	0	0	0	0	0
Rubulac	0	0	0	0	0	0	0	0	0	0
Rubuleu	0	0	0	0	0	0	0	0	0	0
Sambrac	0	0	0	0	0	0	0	0	0	0
Spiridu	0	0	0	0	0	0	0	0	0	0
SympalB1	0	0	0	0	0	0	0	0	0	0
Sympmol	0	0	0	0	0	0	0	0	0	0
Ulexcur	0	0	0	0	0	0	0	0	0	0
Myosalis	0.429	0.25	0.5	0.25	0.2	0.1	0	0	0.167	0.083
Brennol	0.143	0.083	0.5	0.25	0.2	0.1	0.5	1.625	0.5	2.083
Brodcor	0.286	1.083	0.25	4.5	0.2	0.1	0.25	0.125	0.25	0.667
Bronceol	0	0	0	0	0	0	0.5	4.625	0	0
Geramol	0.286	0.167	0.25	1.5	0.2	1.2	0.25	0.125	0.25	1.5
Veroset	0.286	0.167	0.25	0.125	0.4	0.2	0	0	0	0
Lomatut	0	0	0.25	1.5	0.2	0.1	0.25	0.125	0	0
Osmoebi	0.286	1.083	0	0	0	0	0	0	0.25	0.125
Picecon	0.429	4.083	0.25	1.5	0.2	0.1	0	0	0.111	0.056

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

APPENDIX 10 (2) FULL TABLE OF NATIVE PLANT COMMUNITIES (1)

	file=934-C11.xls	file=934-C52.xls	file=934-C45.xls	file=934-C46.xls	file=934-C26.xls	file=934-C16A.N	file=934-C20.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls						
	OAK-	OAK-	OAK-	OAK-(Fb)	OAK-	OAK-	OAK-	OAK-	OAK-	KRUM OAK-						
	DISCR SCOP-	DISC SCOP:	DISCR SCOP-	RHAC CAN-	MAHO AQUI	LOMT HISP	FEST DA:	FEST DA-	FEST DA-	FEST DA-						
	MONT PAR S.C.	TYPIC	SEDU SPA S.C.	SELVA WAL S.C.			TYPIC	CERA ARV S.C.	TRUF MCC S.C.	VICIA AME						
	N=7	N=4	N=5	N=4	N=4	N=9	N=7	N=6	N=4	N=6						
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV						
	COV	COV	COV	COV	COV	COV	COV	COV	COV	COV						
NATIVE PLANT COMMUNITIES OF BEDROCK OUTCROPS																
OTHER NATIVE PLANT COMMUNITIES																
Camargua	0.571	3.083	0.25	1.5	0	0.222	2.056	0.429	3.5	0.5	2.083	0.25	0.125	0.167	1	
Doddeben	0.143	1	0	0	0	0	0.286	2.643	0.333	4	0	0	0	0	0	
Taroff	0.143	0.083	0	0	0	0.222	0.111	0.143	0.071	0	0	0.25	0.125	0	0	
Trifidub	0	0	0	0	0	0.111	0.056	0.429	0.214	0.333	1.083	0.25	0.125	0.5	0.25	
Archeia	0.143	0.083	0	0	0	0	0	0	0	0	0	0	0	0	0	
Allier	0	0	0.2	0.1	0.25	0.125	0	0.43	0.857	0.333	1.083	0.25	1.5	0.5	0.25	
Aerono	0	0	0	0	0	0	0	0.143	0.857	0	0	0	0	0	0	
Charano	0	0	0.2	0.1	0.5	1.625	0	0	0	0	0	0.25	0.125	0.167	0.083	
Heuentic	0.429	1.167	0	0	0.6	1.4	0	0	0.071	0	0	0	0	0.5	0.25	
Nempur	0.286	1.083	0.25	0.125	0.4	0.2	0.25	0.125	0.444	1.444	0.143	0.857	0.333	1.083	0	0
Polymun	0.143	0.083	0	0	0	0	0	0	0	0	0.143	0.071	0	0	0	
Trifiri	0	0	0	0	0	0	0.222	0.772	0.143	0.857	0	0	0.25	0.125	0	0
Tesand	0	0	0	0	0.2	0.1	0.25	0.125	0	0	0	0.25	0.125	0.167	0.083	
Shenav	0	0	0	0	0	0	0.25	0.125	0.111	0.667	0	0	0.25	0.125	0.167	1
Shelait	0	0	0.2	0.1	0	0	0.111	0.056	0	0	0.167	0.083	0.25	1.5	0	0
Adenbic	0	0	0	0	0	0	0	0	0.143	0.071	0	0	0	0	0.167	0.083
Agraocq	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agrosti	0.143	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Atm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alliecu	0	0	0.2	0.1	0.5	0.25	0.5	0.25	0.111	0.056	0.143	0.071	0.333	0.167	0.25	0.125
Allioff	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allivin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Altopecu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aalengc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arabgla	0	0	0	0	0	0	0	0	0	0	0.167	0.083	0	0	0	0
Astcur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Balsdel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bellger	0	0	0	0	0	0	0	0	0	0	0.167	0.083	0	0	0	0
Brechalb	0.143	1	0.25	1.5	0	0	0.111	0.667	0.143	0.071	0.167	0.083	0	0	0	0
Brachyl	0	0	0	0	0.25	1.5	0	0	0	0	0	0	0	0	0	0
Bronaide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromrig	0	0	0.5	1.625	0	0	0.222	2.056	0	0	0.5	2.083	0.25	1.5	0.167	0.083
Bromus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromvul	0	0	0	0	0	0	0.111	0.056	0	0	0	0	0	0	0	0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LA YER SPECIES
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

APPENDIX 10 (2) FULL TABLE OF NATIVE PLANT COMMUNITIES (1)

	file=934-C11.xls	file=934-C21.xls	file=934-C45.xls	file=934-C46.xls	file=934-C26.xls	file=934-C16A.xls	file=934-20.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls
	OAK-	OAK-	OAK-	OAK-(Tdy)	OAK-	OAK-	OAK-	OAK-	OAK-	KRUM OAK-
	DIGR SCOP	DISC SCOP-	DISCR SCOP-	RHAC CAN-	MAHO AQUIT	LONI HSP	FEST IDA-	FEST IDA-	FEST IDA-	FEST IDA-
	MONT PAR S.C.	TPIC	SPDU SPA S.C.	SELA WAL S.C.			TPIC	CERA ARV S.C.	TRIF MCC S.C.	VICIA AME
	N=7	N=4	N=5	N=4	N=4	N=9	N=7	N=6	N=4	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV	COV
NATIVE PLANT COMMUNITIES OF BEDROCK OUTCROPS										
OTHER NATIVE PLANT COMMUNITIES										
Calacil	0	0	0	0	0	0	0	0	0	0
Capstur	0	0	0	0	0	0	0	0	0	0
Candoli	0.429	0.25	0	0.2	0.1	0.25	0.125	0	0.111	0.056
Candpul	0.143	0.083	0.25	0.125	0	0	0.125	0	0.143	0.071
Candrev	0	0	0	0	0	0	0	0	0	0
Carex	0	0	0	0	0	0	0	0	0	0
Caathis	0	0	0	0	0	0	0	0.167	0.083	0
Centrya	0	0	0	0	0	0	0	0	0.25	1.5
Cenari	0	0	0	0	0	0	0	0	0.286	0.929
Chcaalb	0	0	0	0	0	0	0	0	0	0
Chrytleu	0	0	0	0	0	0	0	0	0	0
Cirsary	0	0	0	0.2	0.1	0	0	0	0	0
Cirsium	0	0	0	0	0	0.25	0.125	0.25	0.125	0
Cirsul	0	0	0	0	0	0	0.125	0	0	0
Cladina	0	0	0	0	0	0.25	1.5	0	0.143	0.857
Cladinal	0	0	0	0	0	0	0	0	0	0
Cladran	0	0	0.25	1.5	0	0	0	0	0	0
Clacri	0	0	0	0	0	0	0	0	0	0
Collgra	0	0	0	0	0	0.25	0.125	0	0	0
Commumb	0	0	0	0	0	0	0	0	0	0
Commumc	0	0	0	0	0	0	0	0	0	0
Comipac	0	0	0.25	1.5	0.2	0.1	0	0	0	0
Conium	0	0	0	0	0	0	0	0	0	0.167
Cornalo	0	0	0	0	0	0	0	0	0	0
Cryptri	0	0	0	0	0	0	0	0	0	0
Cyaltta	0	0	0	0	0	0	0	0.143	0.071	0
Daucar	0	0	0	0	0	0	0.25	0.125	0	0
Daucpul	0	0	0	0	0	0	0	0	0	0
Delpmen	0.286	1.083	0	0.4	0.2	0	0.25	0.125	0	0.167
Desces	0	0	0	0	0	0	0	0	0	0
Digipur	0	0	0	0	0	0	0.111	0.056	0	0
Diplose	0	0	0	0	0	0	0	0	0	0
Drabver	0	0	0	0	0	0	0	0	0	0
Drepuac	0	0	0	0	0	0	0	0	0	0
Eadyvon	0	0	0	0	0	0	0	0	0	0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file=934-C11.xls	file=934-C52.xls	file=934-C45.xls	file=934-C46.xls	file=934-C26.xls	file=934-C16A.xls	file=934-20.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls						
	OAK- DICR SCOP- MONT PAR S.C. PRES AV COV	OAK- DISC SCOP- TYPIC PRES AV COV	OAK- DISC SCOP- SEDU SPA S.C. PRES AV COV	OAK- (F0)- RHAC CAN- SELA WAL S.C. PRES AV COV	OAK- MAHO AQU- LONT HISP PRES AV COV	OAK- FEST DA- TYPIC PRES AV COV	OAK- FEST DA- CERA ARV S.C. PRES AV COV	OAK- FEST DA- TRIF MCC S.C. PRES AV COV	OAK- FEST DA- VICIA AME PRES AV COV	OAK- FEST DA- KRUM OAK- PRES AV COV						
Epilobium	0	0	0	0	0.25	0.125	0.111	0.056	0.143	0.071	0	0	0.5	0.25	0	0
Ericaceae	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.125	0	0
Euphorbia	0.286	11.5	0	0	0.4	2.4	0	0	0.25	1.5	0.111	0.667	0.143	0.857	0	0
Festuca	0	0	0	0	0.2	0.1	0	0	0.222	0.722	0.143	0.857	0	0	0	0
Festuca	0.286	0.167	0	0	0	0	0.25	0.125	0	0	0.111	2	0.143	0.071	0	0
Festuca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Festuca	0.143	0.083	0	0	0	0	0	0	0.25	0.125	0	0	0	0	0.25	0.125
Fragaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geranium	0	0	0	0	0.2	0.1	0	0	0.25	0.125	0	0	0	0	0	0
Geranium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Goodenia	0.143	0.083	0	0	0.2	0.1	0	0	0	0	0	0	0	0	0	0
Hieracium	0.143	0.083	0	0	0.2	0.1	0.225	0.125	0	0	0.111	0.056	0	0	0	0
Helleborus	0.143	0.083	0	0	0.2	0.1	0	0	0.222	0.722	0.286	0.143	0.5	1.167	0	0
Hemerocallis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Horsetail	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hyssopus	0	0	0	0	0	0	0	0	0.25	0.125	0	0	0	0	0	0
Hyssopus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isotria	0	0	0	0	0	0	0	0	0.25	1.5	0	0	0	0	0	0
Juncus2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kochia	0	0	0	0	0	0	0	0	0.25	1.5	0.111	2	0	0	0.167	1
Lactuca	0.143	0.083	0	0	0	0	0	0	0.25	0.125	0	0	0	0	0.25	1.5
Lactuca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laminaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laportea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Labium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lilium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lilium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lilium	0	0	0	0	0	0	0	0	0.25	1.5	0	0	0	0	0	0
Listera	0.143	0.083	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Listera	0	0	0	0	0.25	0.125	0	0	0	0	0	0	0	0	0	0
Lolium	0	0	0	0	0	0	0	0	0	0	0.143	0.071	0	0	0	0
Lolium	0	0	0	0	0	0	0	0	0	0	0.143	0.857	0	0	0	0
Lomatium	0	0	0	0	0	0	0	0	0.25	0.125	0	0	0	0	0.167	1
Lomatium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lomatium	0	0	0	0	0.2	0.1	0.5	1.625	0.25	0.125	0	0	0	0	0.25	0.125

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

APPENDIX 10 (2) FULL TABLE OF NATIVE PLANT COMMUNITIES (1)

	file=934-C11.xls	file=934-C57.xls	file=934-C45.xls	file=934-C46.xls	file=934-C26.xls	file=934-C16A.x	file=934-20.xls	file=934-C25.xls	file=934-C27.xls	file=934-C42.xls
	OAK- DICR SCOP- MONT PAR S.C. N=7 PRES AV COV	OAK- DISC SCOP- TYPIC N=4 PRES AV COV	OAK- DISCR SCOP- SEDU SPA S.C. N=5 PRES AV COV	OAK- (Fuj) RHAC CAN- SELA WAL S.C. N=4 PRES AV COV	OAK- MAHO AQUT N=4 PRES AV COV	OAK- LONI HISP N=9 PRES AV COV	OAK- FEST DA- TYPIC N=7 PRES AV COV	OAK- FEST DA- CERA ARV S.C. N=6 PRES AV COV	OAK- FEST DA- TRIF MCC S.C. N=4 PRES AV COV	KRUM OAK- FEST DA- VICIA ANE N=6 PRES AV COV
	NATIVE PLANT COMMUNITIES OF BEDROCK OUTCROPS									
	OTHER NATIVE PLANT COMMUNITIES									
Rhaetel	0	0	0.2	3.6	0	0	0	0	0	0
Rhinert	0	0	0	0	0	0	0	0	0	0
Runcosa	0	0	0	0	0.25	0.125	0	0	0	0
Runcul	0	0	0	0	0	0	0	0	0	0
Sanigra	0.143	0.083	0	0	0	0	0	0	0	0
Satuden	0	0	0	0	0.25	0.125	0.25	1.5	0.222	6.222
Saxiat	0	0	0.25	0.125	0	0	0	0	0.143	0.071
Sodulan	0	0	0.25	0.125	0	0	0	0.286	0.143	0.143
Sodum	0	0	0	0	0	0	0	0	0	0
Senecio	0	0	0	0	0	0	0	0	0	0
Senecvii	0	0	0	0	0	0	0	0	0	0
Sisydou	0	0	0	0	0	0	0	0	0	0
Smiliste	0	0	0	0	0	0	0	0	0	0
Solanrg	0	0	0	0	0	0	0	0	0	0
Soncarv	0	0	0	0	0.25	0.125	0.111	0.056	0.143	0.071
Stiplem	0	0	0	0	0.25	0.125	0.111	0.056	0.143	0.071
Thaloc	0	0	0	0	0	0	0	0	0	0
Tortur	0	0	0	0	0	0	0.111	0.667	0	0
Tragpot	0	0	0	0	0	0	0	0	0	0
Tridral	0.143	0.083	0	0	0	0	0	0	0	0
Tridlap	0	0	0	0	0	0	0	0	0	0
Triflyb	0	0	0	0	0	0	0	0	0	0
Trifanc	0	0	0	0	0	0	0	0	0	0
Trifoli	0	0	0.25	1.5	0	0	0.111	0.667	0	0
Trifrep	0	0	0	0	0	0	0	0	0	0
Trifrub	0	0	0	0	0.25	0.125	0	0	0	0
Trifrar	0	0	0	0	0	0.125	0	0	0	0
Trifras	0	0	0	0	0	0	0	0	0	0
Trilhya	0	0	0	0	0	0	0.25	1.5	0	0
Vcroame	0	0	0	0	0	0	0	0	0	0
Veronic	0	0	0	0	0	0	0	0	0	0
Vicia	0	0	0	0	0	0	0	0	0	0
Viciaa	0	0	0	0	0	0	0	0	0	0
Vioemta	0	0	0	0	0	0	0	0	0	0
Violpra	0	0	0	0	0	0	0	0	0.167	0.083
Zigavena	0	0	0.25	1.5	0	0	0.5	0.25	0	0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file=934-c47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
	ELYM GLAU	BROM CAR	LATHNEY	CARE INOPS	IMELI SUB	HOLO DISC-	HOLO DISC-	ROSA NUTK-	ROSA NUTK-
	N=14	N=6	N=5	N=6	N=12	POLY GLYC	RHYT TRI	LONI CIL S. C.	OEML CER S. C.
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV
OTHER NATIVE PLANT COMMUNITIES CONT.									
Monper	0.357	1.357	0.5	4.083	0	0	0	0	0
Montpar	0	0	0	0	0	0	0	0	0
Rhyvri	0.214	2.143	0	0	0	0	0	0	0
Polygly	0.214	0.5	0	0	0	0	0	0	0
Aitupra	0.071	0.036	0.167	0.083	0	0	0	0	0
Anthoda	0.286	0.929	0.5	3.167	0.4	8.8	0.5	5	0.25
Bromcar	0.571	1.071	1	28.83	0.6	2.5	0.333	4	0.667
Elymgra	1	28.57	0.833	2.25	0.2	3.6	0.833	5	1
Galapa	0.929	9.143	1	11.08	0.6	8.4	0.833	7	1
SympalbB2	0.643	16.75	0.5	12.33	0.8	21.5	0.5	9.417	0.5
Dierseo	0.071	0.429	0	0	0	0	0	0	0
Seduspa	0	0	0	0	0	0	0	0	0
Rhaccan	0.143	0.857	0	0	0	0	0.5	3	0
Festidah	0.429	1.393	0.333	1.083	0	0	0.667	2.167	0.333
Lotumic	0.143	0.464	0	0	0	0	0.667	3.083	0
Festbro	0.5	1.429	0.833	5.167	0.8	9	0	0	0
Lonhis	0.357	6.607	0.333	1.083	0	0	0.333	1.083	0.333
Luzumul	0.143	0.464	0	0	0.2	0.1	0.5	1.167	0.333
Polyjun	0	0	0	0	0	0	0	0	0.083
Selawal	0.214	0.107	0.167	0.083	0	0	0	0	0
Colpar	0	0	0.167	1	0	0	0.333	2	0.25
Crepmod	0.143	0.071	0	0	0	0	0	0	0
Eriolan	0.286	0.143	0	0	0	0	0.167	0.083	0
Plyvri	0.071	0.036	0	0	0	0	0	0	0
Achimil	0.357	1.821	0.667	1.25	0.2	0.1	0.333	0.167	0.25
Rumance	0.429	0.214	0	0	0	0	0.833	1.333	0.25
Bromsis	0.643	5.429	0.833	10.08	0.8	8.5	0.5	1.167	0.583
Cynoch	0.643	3.607	0.5	2.083	0.2	0.1	0.5	9.417	0.167
MahoqubB2	0.357	2.214	0.5	5	0.6	1.4	0.5	1.167	0.5
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES									
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.									

	file=934-c47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls									
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-(FD)-	OAK-	OAK-									
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLO DISC-	HOLO DISC-	ROSA NUTK-	ROSA NUTK-									
	N=14	N=6	N=5	N=6	N=12	POLY GLYC	RHHT TRL	LONI CIL S. C.	OEMIL CER S. C.									
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV									
	COV	COV	COV	COV	COV	COV	COV	COV	COV									
OTHER NATIVE PLANT COMMUNITIES CONT.																		
Viehrir	0.357	4.893	0.667	4	0.6	7.3	0.833	6.25	0.667	4.542	0	0	0.455	1.227	0	0		
Vieisat	0.643	4.393	1	18.58	0.8	8.5	1	3.25	0.75	6.125	0	0	0.4	0.2	0.727	2.864	0.3	1.25
Cernarv	0.643	5.643	0.667	2.167	0	0	0.5	5	0.417	0.667	0.111	0.056	0.2	0.1	0.273	0.136	0	0
Saniteru	0.929	6.5	0.667	8	1	4.9	0.667	4	1	10.63	0.222	0.722	1	6	0.455	2.227	0.4	1.3
Pon piru	0.643	7.071	0.667	4.167	0.8	6.1	0.5	4.083	0.917	7.875	0.667	0.333	0.6	3.8	0.909	4.545	0.6	3.7
Hyporad	0.143	0.071	0.167	0.083	0.4	0.2	0.667	0.333	0.333	0.167	0.556	0.889	0.2	0.1	0.364	0.182	0.3	0.15
Trifoig	0.214	0.107	0	0	0	0	0.333	1.083	0	0	0	0	0.2	0	0	0	0	0
Trifmcc	0.143	0.071	0	0	0	0	0.167	0.083	0.167	0.542	0	0	0.2	1.2	0	0	0	0
Aircar	0.214	0.107	0.333	1.083	0	0	0.167	0.083	0.167	0.083	0.333	0.778	0.2	0.1	0	0	0	0
Cureino	0.714	10.64	0	0	0.4	0.2	1	43	0.417	2.583	0.333	0.778	1	2.7	0.091	0.545	0.1	0.05
Cumulei	0.5	6.036	1	9.083	0.8	20	0.167	1	0.5	2.625	0.889	13.33	0.6	11.3	0.636	4.5	0.5	3.65
Viciane	0.357	3.464	0.5	4.083	0.2	3.6	0.167	1	0.25	1.042	0.111	0.667	0.8	1.5	0.364	1.682	0.1	0.05
Planlan	0.143	0.071	0.5	0.25	0.8	7.4	0.667	0.333	0.5	1.167	0.111	0.056	0.2	0.1	0.455	0.227	0.1	0.6
Lathnev	0.214	0.893	0.167	1	1	26	0.167	3	0.25	0.583	0.333	0.778	0.4	2.4	0.273	4.545	0.3	1.25
Dactglo	0.214	1.286	0.5	4.083	1	19.6	0.333	2	0.5	3.625	0.444	6.056	0.8	1.5	0.818	10.77	0.8	5.55
Ranuce	0.429	1	0.333	2	0.2	1.2	0.833	4.083	0.417	1.125	0.111	0.056	0	0	0.182	0.091	0.1	1.8
Danteal	0.286	5	0	0	0	0	0.833	2.25	0.25	0.125	0	0	0	0	0	0	0	0
Melisub	0.571	6.464	0.167	0.083	0.2	1.2	0.5	2.083	1	34.25	0.222	0.722	0.4	7.7	0.545	3.955	0.2	0.65
CytiscoB2	0.571	3.036	0.333	3.083	0.4	2.4	0.167	0.083	0.583	5.583	0.778	6.772	0.8	2.6	0.455	2.227	0.2	0.1
HolodisB1	0.286	3.429	0.167	3	0.2	7.6	0.333	7.333	0.333	6.75	0.222	11.22	1	54	0.545	15.36	0.5	8.6
HolodisB2	0.214	2.143	0.667	4	0.2	1.2	0.333	1.083	0.25	2.5	0.778	7.722	0.6	7.3	0.455	5.727	0.2	2.4
Arenmac	0.071	1.286	0	0	0	0	0	0	0.25	1.583	0.111	0.056	1	0.5	0.182	0.591	0.1	0.05
Stelmed	0.357	1.429	0.5	1.167	0.4	0.2	0.333	0.167	0.583	2.125	0.556	1.5	0.8	1.5	0.091	0.545	0.2	0.65
Eylore	0.214	0.107	0	0	0.6	8.9	0.333	3.083	0.25	0.125	0.444	1.444	0.8	5	0.273	0.636	0.4	1.85
Fritlan	0.143	0.071	0	0	0.2	0.1	0.5	3.167	0.167	0.542	0.111	0.056	0.8	0.4	0.273	0.636	0	0
LonticB1	0	0	0	0	0	0	0	0	0	0	0.111	0.056	0	0	0.727	5.545	0	0
Lonticil	0	0	0	0	0	0	0.167	1	0.167	0.542	0.111	0.667	0.4	0.2	1	18.36	0	0
Rosanub1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.364	8.364	0.5	13.8
Rossanur	0.071	1.286	0	0	0.4	2.4	0.167	3	0.083	0.5	0.444	1.444	0.2	1.2	0.818	20.55	0.9	22.45

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file=934-c47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls						
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK- (FD)-	OAK-	OAK-						
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLI DISC.	HOLI DISC.	ROSA NUTK-	ROSA NUTK-						
	N=14	N=6	N=5	N=6	N=12	N=9	N=5	N=11	N=10						
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV						
	COV	COV	COV	COV	COV	COV	COV	COV	COV						
OTHER NATIVE PLANT COMMUNITIES CONT.															
Qemlecr	0.071	0.036	0.167	1	0	0	0	0.111	0.056	0	0	0.364	2.273	0.9	18.55
QemlecrB2	0	0	0.167	3	0.2	0.1	0	0.222	0.722	0.2	3.6	0.273	0.136	0.6	10.5
Daphlau	0.214	1.75	0	0	0.4	2.4	0	0.222	0.722	0.4	1.3	0.455	5.136	0.8	2.7
QuegauA	0.714	40	0.333	16.83	1	63	0.833	52.5	0.75	40.17	0.667	29.22	1	45	53.4
QuegauB1	0.714	32.36	1	55.5	0.8	13.6	0.5	12.33	0.833	30.67	0.889	31.89	1	23.8	21.2
QuegauB2	0.643	6.893	1	30.5	0.4	7.7	0.333	9.333	0.75	15.04	0.778	15.17	0.8	10.1	3.15
Quegard	0.786	2.821	0.833	10.08	0.8	1.5	0.667	1.25	0.75	2.292	0.889	1.056	1	0.5	0.3
Pseuena	0.286	8	0.167	3	0.2	7.6	0.333	4	0.5	18.58	0.333	5.556	0.8	9.6	0
PseunenB1	0.071	0.429	0	0	0	0	0	0	0.25	2.5	0.111	0.667	0.2	1.2	0.273
PseunenB2	0.143	0.464	0	0	0	0	0	0	0.167	3	0	0	0.2	1.2	0.091
Pseumend	0.286	0.143	0	0	0	0	0.167	0.083	0.25	0.125	0	0	0.273	0.136	0
Abiegrab1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AbiegrabD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acernaca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AcernacB1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AcernacB2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AcernacD	0.143	0.071	0	0	0	0	0	0	0.25	0.125	0	0	0.091	0.045	0
Arbumena	0	0	0	0	0	0	0.333	3.083	0.167	2	0.111	0.667	0.2	3.6	0
ArbumenB1	0.071	0.429	0	0	0	0	0.667	6	0.417	3.5	0	0	0.091	1.636	0
ArbumenB2	0	0	0	0	0	0	0.167	1	0.167	0.542	0	0	0.091	0.045	0
ArbumenD	0	0	0	0	0	0	0	0	0	0	0.111	0.667	0	0	0
JuniscoA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JuniscoB1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JuniscoB2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PinuponB1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AmelnaB1	0	0	0	0	0.2	3.6	0	0	0	0	0	0	0.091	0.545	0.2
AmelnaD	0.143	1.321	0.167	0.083	0.2	1.2	0.333	1.083	0.25	1.042	0.272	1.333	0.6	1.4	0.4
CyiscoB1	0.071	1.286	0.167	10.5	0.2	1.2	0	0	0.167	1	0.222	2.056	0	0	0.3
HedeheEP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES															
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.															

	file=934-c47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls		
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-(FD)-	OAK-	OAK-		
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLY GLYC	HOLY DISC-	ROSA NUTK-	ROSA NUTK-		
	N=14	N=6	N=5	N=6	N=12	N=9	N=5	N=11	N=10		
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV		
	COV	COV	COV	COV	COV	COV	COV	COV	COV		
OTHER NATIVE PLANT COMMUNITIES CONT.											
HedhelB1	0	0	0	0	0	0	0	0.182	1.091	0.3	5
HedhelB2	0	0	0	0	0	0.222	0.722	0.182	6.909	0.4	7
LonhisB1	0	0.167	1	0	0.083	0.042	0	0.182	0.091	0	0
Ruburs	0	0	0	0.167	3	0.167	0.083	0.455	8.636	0.4	1.85
Arctcol	0.071	1.286	0	0	0	0	0	0	0	0	0
Arctuva	0	0	0	0	0	0.222	0.111	0	0	0	0
CornserB1	0	0	0	0	0	0	0	0	0	0.1	0.6
CornserB2	0	0	0	0	0	0	0	0	0	0.1	0.05
Crataegu	0	0	0	0	0	0	0	0	0	0	0
CratdouB1	0	0	0	0	0	0	0	0	0	0.1	0.6
CratdouB2	0	0	0	0	0	0	0	0	0	0.1	0.05
CratmonB1	0	0	0	0.167	3	0	0	0.091	0.045	0.1	0.05
CratmonB2	0	0	0	0.167	1	0.083	0.042	0.182	1.091	0	0
Gaulsha	0	0	0	0	0	0	0	0.091	0.545	0.1	0.6
Ilexcur	0	0	0	0	0	0	0	0	0	0	0
IlexcurB2	0	0	0	0	0	0	0	0	0	0.1	0.05
LychalB2	0	0	0	0	0	0	0	0	0	0	0
MahaaguB1	0	0	0	0	0	0	0	0	0	0.1	0.05
Mahonc	0	0	0	0	0.083	0.042	0	0.091	0.045	0	0
Malus	0	0	0	0	0	0	0	0	0	0	0
Cotoneas	0	0	0	0	0	0	0	0	0	0	0
Paxinyr	0.071	0.036	0.167	0.083	0	0.083	0.042	0	0	0	0
PhillewB1	0	0	0	0	0	0.111	0.056	0.2	0.1	0	0
PhillewB2	0	0	0	0	0	0	0	0.091	0.545	0.2	0.1
PhyscagB1	0	0	0	0	0	0	0	0	0	0.1	0.6
Prunemab1	0.071	0.429	0	0	0.083	0.042	0	0.091	1.636	0.2	2.4
Prudemab2	0	0	0	0	0	0	0	0.091	0.545	0.1	0.6
PrunusB1	0	0	0	0	0	0	0	0.091	0.545	0.1	0.6
Prunvir	0	0	0	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES											
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.											

	File=934-cd7.xls	File=934-C43.xls	File=934-C41.xls	File=934-C14.xls	File=934-C13.xls	File=934-C15.xls	File=934-C10.xls	File=934-C8.xls	File=934-C9.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLO DISC-	HOLO DISC-	ROSA NUTK-	ROSA NUTK-
	N=14	N=6	N=5	N=6	N=12	N=9	N=5	N=11	N=10
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV
OTHER NATIVE PLANT COMMUNITIES CONT.									
PrunvirB2	0	0	0	0	0	0	0	0	0
RhampurB1	0	0	0	0	0	0	0	0	0
Rhampur	0	0	0	0	0	0	0	0.091	0.045
Rosa	0	0	0.2	0.1	0.083	0.042	0	0.091	0.045
Rosegym	0.357	0.964	0	0	0.25	1.042	0.222	2.667	0.2
Rosapis	0	0	0	0	0	0	0	0	0
Rubupro	0	0	0.167	1	0	0	0.111	0.056	0.2
RubuproB1	0	0	0	0	0	0	0	0	0
Rubulac	0	0	0	0	0	0	0	0	0
Rubuleu	0	0	0	0	0.167	1.542	0	0	0.2
Sambarc	0	0	0	0	0	0	0	0	0
Spiridou	0	0	0	0	0.167	0.083	0	0	0
SympalB1	0	0	0	0	0	0	0	0	0
Sympmol	0.071	1.286	0	0	0	0	0	0	0
Ulexeur	0.071	0.429	0	0	0	0	0	0	0
Myosdis	0.071	0.036	0.5	0.25	0.333	1.083	0.5	0.25	0
Brommol	0.5	0.643	0.333	0.167	0.6	0.3	0	0	0.222
Brodcor	0.286	2.643	0.333	2	0.2	1.2	0.667	5.083	0.167
Bromic	0	0	0	0	0	0	0	0	0
Geramol	0.286	1.393	0.167	1	0.333	0.167	0.417	4.708	0.111
Veroser	0.214	0.107	0.167	0.083	0	0	0.333	0.167	0.25
Lomaur	0.286	1.393	0	0	0.667	4.167	0	0	0.111
Osmochi	0.357	5.286	0	0	0.333	0.167	0.5	5.083	0.222
Pleacon	0.357	0.571	0	0	0.167	1	0.167	0.542	0.222
Camagua	0.143	1.714	0.167	1	0.2	3.6	0.667	8	0.083
Dodclen	0.286	0.143	0	0	0.4	0.2	0	0	0.333
Tarnoff	0	0	0.167	0.083	0.6	1.4	0	0	0.25
Trfidub	0	0	0.167	0.083	0.4	4.8	0	0	0.125
Arthula	0	0	0	0	0.2	1.2	0	0	0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES
 Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file=934-c47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-(FD)-	OAK-	OAK-
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLO GLYC	HOLO DISC-	ROSA NUTK-	ROSA NUTK-
	N=14	N=6	N=5	N=6	N=12	N=9	N=5	N=11	N=10
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV
OTHER NATIVE PLANT COMMUNITIES-CONT.									
Bromvul	0	0	0	0	0.083	0	0.2	0.182	0
Galaci	0	0	0	0	0	0	0	0	0
Cagshur	0	0	0	0	0	0	0	0	0
Cardoli	0.143	0.071	0	0	0.333	0	0.2	0.091	0.1
Cardpul	0.071	0.036	0	0.2	0	0	0.4	0.091	0.1
Carebre	0	0	0	0	0	0	0	0	0
Carex	0	0	0	0	0	0	0	0	0
Cashis	0	0	0	0	0	0	0	0	0
Catecya	0.071	0.429	0	0	0	0.111	0	0	0
Cetrari	0.071	0.429	0	0	0	0	0.2	0	0
Chenaltb	0	0	0	0	0	0	0	0.091	0
Chryleu	0	0	0	0	0	0	0	0	0
Cirsarv	0	0	0	0	0	0	0	0	0
Cirsium	0	0	0	0	0	0	0	0	0
Cirsul	0.071	0.036	0	0	0	0	0.4	0.182	0.1
Cladina	0	0	0	0	0	0	0	0	0
Cladinal	0	0	0	0	0	0	0.2	0	0
Cladran	0	0	0	0	0	0.111	0.2	0	0
Clacori	0	0	0	0	0	0	0.1	0	0
Collgra	0	0	0	0	0	0	0	0	0
Comaumb	0	0	0	0	0	0	0	0	0
Continac	0	0	0	0	0	0.111	0	0	0
Conpac	0	0	0	0	0	0.111	0	0	0
Contium	0	0	0	0	0	0	0	0	0
Corralo	0	0	0	0	0	0	0	0	0
Crepis2	0.071	0.036	0	0	0	0	0	0	0
Crypter	0	0	0	0	0	0	0	0	0
Cysfra	0.071	0.036	0	0	0	0	0.4	0.091	0
Daucour	0	0	0	0	0	0	0	0	0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

APPENDIX 10 (3) FULL TABLE OF NATIVE PLANT COMMUNITIES (2)

	file=934-e47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls									
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-(FD)	OAK-	OAK-									
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLO GLYC	HOLO DISC-	ROSA NUTK-	ROSA NUTK-									
	N=14	N=6	N=5	N=6	N=12	N=9	N=5	N=11	N=10									
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV									
	COV	COV	COV	COV	COV	COV	COV	COV	COV									
OTHER NATIVE PLANT COMMUNITIES CONT.																		
Daucpuli	0	0	0	0	0	0	0	0	0									
Delipmer	0.214	0.5	0	0	0.167	0.083	0.083	0.042	0.111	0.056	0.2	0.1	0.091	0.045	0.1	0.05		
Desceces	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Digypur	0	0	0	0	0	0	0.167	0.542	0	0	0	0	0	0	0	0		
Diplase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Drabver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.05		
Drepure	0	0	0	0	0	0	0	0	0	0	0	0.2	7.6	0.091	3.455	0	0	
Endymon	0.071	0.036	0	0	0.2	0.1	0	0	0	0	0.222	0.722	0	0	0	0.2	0.1	
Epilmin	0.214	0.107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Eroedic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Eurhare	0.286	2.571	0	0	0.4	8.8	0.167	1	0.417	2.5	0.444	4	0.4	4.8	0.364	4.364	0.5	7.4
Fesanyru	0	0	0	0	0	0	0	0.083	0.042	0.111	0.056	0	0	0	0	0	0	0
Festoc	0	0	0	0	0	0	0	0.333	1.625	0.111	0.056	0.2	1.2	0	0	0	0	0
Fesrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Festuca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fragves	0.071	0.036	0	0	0	0	0	0.083	0.042	0	0	0.2	1.2	0	0	0	0.2	0.65
Fragvir	0	0	0	0	0	0	0	0.083	0.5	0	0	0	0	0	0	0	0.1	0.05
Geracur	0	0	0	0	0	0	0.167	0.083	0	0	0	0	0	0	0	0	0	0
Geranium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Goodohl	0	0	0	0	0	0	0	0.083	0.042	0	0	0	0	0	0.091	0.045	0	0
Hierali	0	0	0	0	0	0	0	0.333	0.167	0	0	0	0	0	0	0	0	0
Holclan	0	0	0.5	2.083	0.4	0.2	0	0.083	0.5	0.111	0.667	0	0	0.455	0.727	0.2	0.65	
Homalot	0.071	0.429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hordmur	0	0	0	0	0	0	0	0	0	0.111	0.667	0	0	0	0	0	0	0
Hypelfor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isalbec	0.071	0.429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juncanc2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Koelmac	0	0	0	0	0	0	0.167	0.083	0	0	0	0	0	0	0	0	0	0
Lactie	0.071	0.429	0	0	0	0	0.333	0.167	0.167	0.083	0	0.2	0.1	0.364	0.182	0.2	0.1	
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES																		

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file=934-47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls				
	OAK- ELYM GLAU	OAK- BROM CAR	OAK- LATHNEV	OAK- CARE INOPS	OAK- MELI SUB	OAK- HOLO DISC- POLY GLYC	OAK- (FD)- HOLO DISC- RHYT TRI	OAK- ROSA NUTK- LONI CIL S.C.	OAK- ROSA NUTK- OEML CER S.C.				
	N=14 PRES AV COV	N=6 PRES AV COV	N=5 PRES AV COV	N=6 PRES AV COV	N=12 PRES AV COV	N=9 PRES AV COV	N=5 PRES AV COV	N=11 PRES AV COV	N=10 PRES AV COV				
OTHER NATIVE PLANT COMMUNITIES CONT.													
Lamiampp	0	0	0	0	0	0.111	0.056	0.2	0.1	0	0	0.2	0.1
Lapscom	0	0	0	0	0	0	0	0	0	0	0	0	0
Lathjap	0	0	0	0	0	0	0	0.091	0.545	0	0	0	0
Lilicol	0	0	0	0	0	0	0	0.091	0.545	0	0	0	0
Linabic	0	0	0	0	0	0	0	0	0	0	0	0	0
Linadel	0	0	0	0	0	0	0	0	0	0	0	0	0
Listcor	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithpar	0	0	0.167	0.083	0	0	0	0	0	0	0	0	0
Loliper	0	0	0	0.6	8.4	0.167	0.083	0	0	0.222	0.111	0	0
Loliprs	0	0	0	0.4	8.8	0	0	0	0	0	0	0	0
Lomanud	0	0	0	0.2	0.1	0	0	0	0	0	0	0	0
Lomainu	0	0	0	0	0	0	0.083	0.042	0	0	0	0	0
Lomari	0.286	1.786	0.167	1	0	0	0.083	0.042	0	0	0	0	0
Lupbic	0	0	0	0	0	0	0	0	0	0	0	0	0
Lupinic	0	0	0	0	0	0	0	0	0	0	0	0	0
Lupinus	0	0	0	0	0	0	0	0	0	0	0	0	0
Lychalb	0	0	0	0	0	0	0	0	0	0	0	0	0
Lychcor	0.071	1.286	0	0	0	0	0.083	0.042	0	0	0	0	0
Lychnis	0	0	0	0	0	0	0	0	0	0	0	0	0
Madisat	0	0	0	0	0	0	0	0	0	0	0	0	0
Mimals	0	0	0	0	0	0	0	0	0	0	0	0	0
Mimugut	0	0	0	0	0	0	0	0	0	0	0	0	0
Monount	0	0	0	0.2	0.1	0	0	0	0	0	0	0	0
Monia	0	0	0	0	0	0	0	0	0	0	0	0	0
Montlin	0	0	0	0	0	0	0	0	0	0	0	0	0
Muschol	0	0	0	0	0	0	0	0	0	0	0	0	0
Narepsc	0	0	0	0.2	0.1	0	0	0	0	0	0	0	0
Orobuni	0	0	0	0	0	0	0.083	0.042	0	0	0	0	0
Orthoca	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES													
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.													

	file = 934-c47.xls	file = 934-C43.xls	file = 934-C41.xls	file = 934-C14.xls	file = 934-C13.xls	file = 934-C15.xls	file = 934-C10.xls	file = 934-C8.xls	file = 934-C9.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK- (FD)-	OAK-	OAK-
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLO DISC- POLY GLYC	HOLO DISC- RHYT TRI	ROSA NUTK- LONI CIL S.C.	ROSA NUTK- OEML CER S.C.
	N=14	N=6	N=5	N=6	N=12	N=9	N=5	N=11	N=10
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV
OTHER NATIVE PLANT COMMUNITIES CONT.									
Orthopus	0	0.167	0.033	0	0	0	0	0	0
Paeonia	0	0	0	0	0	0	0	0	0.1
Panicr	0	0	0	0	0	0	0	0	0
Pelibri	0	0	0	0	0	0	0	0	0
Peligeria	0	0	0	0	0	0	0.2	1.2	0
Perigai	0	0	0	0	0.083	0.042	0	0	0
Platua	0.071	0.429	0	0.167	0.083	0.111	0.056	0.182	0.091
Plausch	0	0	0	0	0	0	0	0	0
Poa ann	0	0.167	0.083	0	0	0.111	0.056	0	0.1
Poa hul	0	0	0.2	0.1	0	0.111	0.667	0	0.05
Poa san	0	0	0	0	0	0	0	0	0
Pohnul	0	0	0	0	0	0.111	0.667	0	0
Polygonu	0	0	0	0	0	0	0	0	0
Polygonu2	0.071	0.036	0	0	0	0	0	0	0
Polypil	0	0	0	0	0	0	0	0	0
Polyspe	0	0	0	0	0	0	0	0	0
Potegia	0	0	0	0	0	0	0	0	0
Pruuvul	0	0	0	0	0	0	0	0	0
Pteragu	0	0	0	0	0	0	0	0	0
Ranucep	0.071	0.036	0	0.167	0.083	0	0	0	0.1
Rhachet	0	0	0	0	0	0	0	0	0
Rhineri	0	0	0	0	0	0	0	0	0
Rumeosa	0	0	0	0	0	0	0	0	0.1
Sanicul	0.071	0.036	0	0	0	0	0	0	0
Sanigra	0.071	0.036	0	0	0	0	0	0	0
Sardou	0.071	1.286	0	0.333	1.083	0.083	0.5	0.273	1.636
Saxint	0	0	0	0	0	0	0	0	0
Sedulan	0	0	0	0.167	0.083	0.083	0.042	0.091	0.045
Sedum	0	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES									

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file=934-c47.xls	file=934-C43.xls	file=934-C41.xls	file=934-C14.xls	file=934-C13.xls	file=934-C15.xls	file=934-C10.xls	file=934-C8.xls	file=934-C9.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-(FD)-	OAK-	OAK-
	ELYM GLAU	BROM CAR	LATHNEV	CARE INOPS	MELI SUB	HOLO DISC-	HOLO DISC-	ROSA NUTK-	ROSA NUTK-
	N=14	N=6	N=5	N=6	N=12	N=9	N=5	N=11	N=10
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV
OTHER NATIVE PLANT COMMUNITIES CONT.									
Senecio	0	0	0	0	0	0	0	0	0
Senevul	0	0	0	0	0	0	0	0	0
Smitisc	0	0	0	0	0	0	0	0	0.1
Solanig	0	0	0	0	0	0	0	0	0.1
Soncarv	0	0	0	0	0	0	0	0.091	0.045
Styplem	0	0	0	0.333	2	0	0	0	0
Thaloc	0	0	0	0	0	0	0	0	0
Tortur	0	0	0	0	0	0	0	0	0
Tragpor	0	0	0	0	0	0	0	0	0
Trielar	0	0	0.2	3.6	0	0	0	0.182	0.591
Trifdep	0	0	0	0	0	0	0	0	0
Triflyb	0	0	0.2	1.2	0	0	0	0	0
Trifmic	0	0	0.2	0.1	0	0	0	0	0
Trifoli	0	0	0	0	0.333	1.083	0	0	0.1
Trifrep	0	0	0.2	1.2	0	0	0	0	0
Trifrub	0	0	0.4	7.2	0	0	0	0	0
Trifar	0	0	0	0	0	0	0	0	0
Trihas	0	0	0	0	0	0	0	0	0
Trihyna	0	0	0.4	0.2	0	0	0.083	0.042	0.333
Veroane	0	0	0	0	0.167	0.083	0	0	0
Veronic	0	0	0	0	0	0	0	0	0
Vicia	0	0	0	0	0.167	0.083	0.2	0.1	0
Vicia	0	0	0	0	0	0	0	0	0
Vincmin	0	0	0	0	0	0	0	0	0
Violpra	0.143	0.071	0	0.2	1.2	0	0	0	0
Zigaven	0.214	0.107	0	0	0.333	2	0.4	0.2	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES									
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.									

Species	file = 934-C50.xls	file = 934-C21.xls	file = 934-C23.xls	file = 934-c31a.xls	file = 934-c29a.xls	file = 934-c28b.xls	file = 934-c28a.xls	file = 934-c30.xls	file = 934-c49.xls
	OAK- RHAC CAN- FEST BROM S.C. N=3 PRES AV COV	OAK- CYNO ECH LATE S. N=9 PRES AV COV	OAK- BROM STER N=9 PRES AV COV	OAK- ANTHO ODOR N=7 PRES AV COV	OAK- POA PRAT N=14 PRES AV COV	OAK- DACT GLOM- BROM CAR S.C. N=5 PRES AV COV	OAK- DACT GLOM TYPIC N=16 PRES AV COV	OAK- DACT GLOM- ARRH ELA S.C. N=5 PRES AV COV	OAK- DACT GLOM- AGRO STO S.C. N=5 PRES AV COV
Clearamo	0.667 0.333	0	0	0	0	0	0	0	0
Achimil	0.667 2.167	0.333 1.389	0.556 1.5	0.429 2.714	0.357 0.571	0.4	1.3	0.25	0.469
Brommol	0.667 8	0.444 2.778	0.556 4.056	0.429 1	0.643 1.893	0.6	1.4	0.438	0.906
Rumrace	0.667 0.333	0.556 5.389	0.222 0.111	0.286 2.643	0.286 0.929	0.2	1.2	0.313	0.844
Aitapra	1 4.167	0.111 0.667	0.111 0.667	0.429 1	0.143 0.071	0	0	0.125	0.063
Brodcor	0.667 0.333	0.444 2.056	0.333 0.778	0.571 6.857	0.357 3.643	0	0	0.313	0.5
Luzumul	0.667 0.333	0	0.111 0.667	0.286 0.143	0.286 0.143	0	0	0.25	0.125
Caraino	0.667 8	0.333 8.222	0	0.429 3.5	0.214 2.607	0	0	0.438	4.344
Lonhis	1 8.167	0.222 2.056	0.333 3.333	0.429 8.071	0.357 0.964	0.2	3.6	0.313	2.344
Triftri	0.667 2.167	0.111 0.056	0	0	0	0	0	0	0
Polyjun	0.667 8	0.111 0.667	0	0.286 1.714	0	0	0	0.125	0.75
Carary	0.667 4	0.667 2.778	0.333 0.778	0.286 5.143	0.5 3.464	0.2	1.2	0.438	1.25
Lautnic	1 10	0.778 6.853	0.111 0.056	0	0.429 2.25	0	0	0.125	0.406
Gynoech	0.667 8	1 57.44	0.333 2.722	0.286 0.143	0.357 4.321	0.2	1.2	0.125	1.219
Rhaccun	1 48	0.889 12.44	0.222 1.333	0.571 5.143	0	0	0	0.125	0.75
Triforce	0.667 4	0.667 11.22	0.111 0.667	0.143 0.857	0.357 2.214	0	0	0.063	0.031
Fastbro	1 35.67	0.333 4.056	0.778 9.556	0.571 1.857	0.714 2.321	0.6	4.9	0.438	3.094
Hyppard	1 0.5	0.333 0.167	0.444 0.833	0.571 1.071	0.714 1.143	0.8	2.6	0.438	0.563
Elymgla	1 8.167	0.889 6.778	0.778 4.167	0.714 5.214	0.929 6.571	0.8	8.5	0.813	7.188
Bromcar	1 2.333	0.222 0.111	0.667 4.111	0.429 1	0.857 3.643	1	18	0.75	4.219
Bromste	0.667 0.333	0.889 8.889	1 41.33	0.429 2.714	0.929 5.964	0.6	2.5	0.563	4.188
Vicilir	0.667 0.333	0.222 0.722	0.889 8.722	0.571 1.857	0.857 11.57	1	9.7	0.75	4.844
Poa pra	0.667 2.167	0.889 10.06	0.444 6.222	1 18.36	28.07	1	30	0.688	15.84
Viciset	0.667 0.333	0.556 8.944	1 13.83	0.714 5.357	0.929 15.29	0.8	9.6	0.813	7.938
Sanicra	1 6.333	0.444 2.056	0.778 8.056	0.714 3.643	0.929 9.929	0.8	2.6	0.875	6.125
Galapa	0.333 0.167	0.667 6.167	0.889 9.833	0.714 3.643	0.857 4.893	0.8	7.2	0.938	9.594
Phaulan	0.333 0.167	0.222 0.722	0.111 0.667	0.714 3.643	0.357 0.964	0.6	4.9	0.5	0.938
Ranuco	0 0	0.222 0.111	0.333 6.278	0.714 1.143	0.214 0.107	0.2	1.2	0.375	1.219
Anthodo	0.333 2	0.333 4.944	0.333 2.722	1 49.43	0.286 3.893	0.4	4.8	0.5	7.813

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES
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	file=934-C50.xls	file=934-C21.xls	file=934-C23.xls	file=934-c31a.xls	file=934-c29a.xls	file=934-c28b.rtl	file=934-c28a.xls	file=934-c30.xls	file=934-c49.xls
	OAK- RHAC CAN- FEST BROM S.C.	OAK- CYNO ECH LATE S.	OAK- BROM STER	OAK- ANTHO ODOR	OAK- POA PRAT	OAK- DACT GLOM- BROM CAR S.C.	OAK- DACT GLOM TYPIC	OAK- DACT GLOM- ARRH ELA S.C.	OAK- DACT GLOM- AGRO STO S.C.
	N=3 PRES AV COV	N=9 PRES AV COV	N=9 PRES AV COV	N=7 PRES AV COV	N=14 PRES AV COV	N=5 PRES AV COV	n=16 PRES AV COV	N=5 PRES AV COV	N=5 PRES AV COV
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)									
Dandel	0.333 2	0.444 5.333	0.111 0.056	0.857 5.286	0.071 0.429	0 0	0.188 0.438	0 0	0.2 0.1
SympaltB2	0.333 0.167	0.222 0.722	0.556 8.944	0.714 7.714	0.643 16.11	0.4 8.8	0.75 11.75	0.5 12.33	0.6 1.4
Trifolub	0.333 0.167	0.444 2.056	0.444 4.722	0.714 5.214	0.5 2.607	0.6 1.4	0.188 0.438	0.5 1.167	0 0
Daeglo	0 0	0.222 0.111	0.333 4.056	0.714 6.143	0.429 3.429	1 48	1 35.81	1 20.67	0.8 29
Geranol	0 0	0.667 8.278	0.333 2.722	0.286 0.143	0.857 12.5	0.6 0.3	0.75 5.031	0.833 3.167	0.6 2.5
Camalel	0.333 0.167	0 0	0.444 2.667	0.571 12.57	0.429 12	0.8 7.4	0.563 7.281	0.5 8.333	0.4 4.8
Arthela	0 0	0 0	0 0	0 0	0.071 1.286	0 0	0 0	1 35.5	0.2 1.2
Agrost	0 0	0 0	0 0	0.143 0.071	0 0	0.2 1.2	0.063 0.031	0 0	1 30
Taraloff	0 0	0 0	0.111 0.056	0.286 0.929	0.286 0.536	0.4 1.3	0.438 0.563	0.5 1.167	0.8 1.5
QuergarA	0.667 18.67	1 60.22	0.667 30.89	0.857 49.43	0.714 46.79	1 63	0.938 51.56	1 50.5	0.8 50.4
QuergarB1	0.667 127	0.444 5.333	0.778 38.44	0.857 18.07	0.714 122.71	1 12.4	0.875 19.81	0.333 9.333	0.4 20.2
QuergarB2	1 8.167	0.778 1.611	0.778 7.722	0.571 6.071	0.643 2.286	0.8 6.1	0.625 3.875	0.5 2.083	0.6 1.4
QuergarD	0.667 4	0.333 0.167	0.667 4.722	0.429 1.786	0.786 1.643	0.6 1.4	0.625 1.688	0.5 0.25	0.8 1.5
Pseudena	0.667 8	0.333 6.889	0 0	0.286 3.429	0.214 3	0 0	0.25 3	0 0	0 0
PseudenB1	0.333 2	0.111 0.667	0 0	0.286 1.714	0.071 0.429	0.2 7.6	0.125 0.75	0 0	0 0
PseudenB2	0.333 6	0 0	0.111 2	0.143 0.857	0 0	0.2 0.1	0 0	0 0	0 0
PseudenD	0.333 0.167	0.111 0.056	0 0	0 0	0 0	0.4 0.2	0 0	0 0	0 0
AbiegraB1	0 0	0 0	0 0	0 0	0 0	0.2 3.6	0 0	0 0	0 0
AbiegraD	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Acernaca	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
AcernacB1	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
AcernacB2	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
AcernacD	0 0	0.222 0.111	0 0	0.286 0.143	0.071 0.036	0.2 0.1	0.063 0.031	0 0	0 0
ArbunenaA	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
ArbunenaB1	0 0	0 0	0 0	0 0	0.071 0.429	0 0	0.063 0.375	0 0	0.2 1.2
ArbunenaB2	0.333 0.167	0.111 0.667	0 0	0.143 0.857	0.071 0.429	0 0	0 0	0 0	0 0
ArbunenaD	0.333 0.167	0 0	0 0	0 0	0 0	0.2 0.1	0 0	0 0	0 0
JuniscoA	0 0	0 0	0 0	0 0	0 0	0 0	0.063 1.125	0 0	0 0
JuniscoB1	0 0	0.111 0.667	0 0	0 0	0.143 1.714	0 0	0 0	0 0	0 0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES									
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.									

	file=934-c30.xls	file=934-c21.xls	file=934-c23.xls	file=934-c31a.xls	file=934-c29a.xls	file=934-c28b.xls	file=934-c28a.xls	file=934-c30.xls	file=934-c49.xls	
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	
	RHAC CAN-	CYNO ECH	BROM STER	ANTHO ODOR	POA PRAT	DACT GLOM-	DACT GLOM	DACT GLOM-	DACT GLOM-	
	FEST BROM S.C.	LATE S.				BROM CAR S.C.	TYPIC	ARRH ELA S.C.	AGRO STO S.C.	
	N=3	N=9	N=9	N=7	N=14	N=5	n=16	N=5	N=5	
	PRES AV	PRES AV	PRES AV		PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	
	COV	COV	COV		COV	COV	COV	COV	COV	
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)										
JuniscoB2	0	0	0	0	0	0	0.063	0.031	0	0
PiuonpB1	0	0	0	0	0	0.2	0	0	0	0
AmelalnB1	0	0	0	0.143	0.857	0.2	0.125	1.5	0	0
Amelaln	0	0.111	0.056	0.286	0.929	0.2	0.125	0.406	0	0
CylicoB1	0	0.111	2	0.111	0.056	0	0.188	0.781	0.167	1
CylicoB2	0.667	2.167	0.222	2.667	0.333	6.889	0.375	1.563	0.333	16.83
HolodisB1	0	0	0	0.222	2.667	0.2	0.313	6.594	0	0
HolodisB2	0	0	0	0.286	0.143	0.2	0.313	6.625	0	0
MahoquB2	0.333	0.167	0.111	0.667	0.444	4	0.357	2.214	0.167	0.083
Oemlecr	0	0	0.111	0.667	0.143	0.071	0.063	0.375	0.167	1
OemlecrB2	0	0	0	0	0	0.071	0.25	0.469	0	0
RosanuiB1	0	0	0	0	0	0	0.063	0.375	0	0
RosanuiB2	0.333	0.167	0	0.143	0.857	0.214	0.188	1.875	0.167	1
Ruburs	0	0	0	0.143	0.857	0.071	0	0	0	0
Daphlau	0	0	0	0	0	0.143	0.438	0.563	0.167	0.083
HedhelEP	0	0	0	0	0	0	0	0	0	0
HedhelB1	0	0	0	0	0	0	0	0	0	0
HedhelB2	0	0	0	0	0	0	0.063	0.375	0	0
LoniceB1	0	0	0	0	0	0	0	0	0	0
LoniceB2	0	0	0.111	0.667	0.143	0.071	0.063	0.375	0	0
Arctcol	0	0	0	0	0	0	0	0	0	0
Arctuva	0	0	0	0.143	0.857	0	0	0	0	0
CornserB1	0	0	0	0	0	0	0	0	0	0
CornserB2	0	0	0	0	0	0	0	0	0	0
Crategu	0	0	0	0	0	0	0.063	0.031	0	0
CraddouB1	0	0	0	0	0	0	0	0	0	0
CraddouB2	0	0	0	0	0	0	0	0	0	0
CratronB1	0	0	0	0	0	0	0.063	0.031	0	0
CratronB2	0	0	0	0.143	2.571	0.4	0.125	0.063	0	0.2

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file=934-C50.xls	file=934-C21.xls	file=934-C23.xls	file=934-c31a.xls	file=934-c29a.xls	file=934-c28b.xl	file=934-c28a.xls	file=934-c30.xls	file=934-c49.xls
	OAK- RHAC CAN- FEST BROM S.C. N=3 PRES AV COV	OAK- CYNO ECH LATE S. N=9 PRES AV COV	OAK- BROM STER N=9 PRES AV COV	OAK- ANTHO ODOR N=7 PRES AV COV	OAK- POA PRAT N=14 PRES AV COV	OAK- DACT GLOM- BROM CAR S.C. N=5 PRES AV COV	OAK- DACT GLOM TYPIC N=16 PRES AV COV	OAK- DACT GLOM- ARRH ELA S.C. N=5 PRES AV COV	OAK- DACT GLOM- AGRO STO S.C. N=5 PRES AV COV
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)									
Gaulthra	0	0	0	0	0.071	0.036	0	0	0
Ilexeur	0	0	0	0	0	0	0	0	0
IlexeurB2	0	0	0	0	0	0	0	0	0
LycihalB2	0	0	0	0	0	0	0	0	0
LonitisB1	0	0	0	0	0	0	0	0	0
MahoaguB1	0	0	0	0	0	0	0	0	0
Maloneer	0	0	0	0	0	0	0.063	0.031	0
Malus	0	0	0	0.143	0.071	0	0	0	0
Coloneas	0	0	0	0	0	0	0	0	0
Paximyr	0	0	0	0	0	0	0.063	0.031	0
PhillewB1	0	0	0	0	0	0	0	0	0
PhillewB2	0	0	0	0	0	0	0	0	0
PhyscapB1	0	0	0	0	0	0	0	0	0
PrunemaB1	0	0	0	0	0	0	0	0	0
PrunemaB2	0	0	0	0	0	0	0	0	0
PrunusB1	0	0	0	0	0	0	0.063	0.031	0
Prunvir	0	0	0	0	0	0	0	0	0
PrunvirB2	0	0	0	0	0	0	0	0	0
RhampurB1	0	0	0	0	0	0	0	0	0
Rhampur	0	0	0	0	0	0	0	0.167	0.083
Rosa	0	0.111	0.667	0	0.071	0.429	0	0	0
Rosagym	0.333	0.167	0	0.286	2.643	0.071	0.429	0.063	0.031
Rosapis	0	0	0	0	0.071	0.036	0	0	0
Rubupro	0	0.111	0.667	0	0	0	0.125	0.063	0.333
RubuproB1	0	0	0	0	0	0	0	0.333	3.083
Rubulac	0	0	0	0	0	0	0.063	0.031	0.2
Rubuleu	0	0	0	0	0	0	0.063	0.375	0
Sambrac	0	0	0	0	0	0	0	0	0
Spiridou	0	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES									
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.									

	file=934-C30.xls	file=934-C21.xls	file=934-C23.xls	file=934-c31a.xls	file=934-c29a.xls	file=934-c28b.xls	file=934-c28a.xls	file=934-c30.xls	file=934-c49.xls
	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-	OAK-
RHAC CAN-		CYNO ECH	BROM STER	ANTHO ODOR	POA PRAT	DACT GLOM-	DACT GLOM	DACT GLOM-	DACT GLOM-
FEST BROM S. C.		LATE S.				BROM CAR S. C.	TRYPIC	ARRH ELA S. C.	AGRO STO S. C.
N=3		N=9	N=9	N=7	N=14	N=5	N=16	N=5	N=5
PRES AV		PRES AV	PRES AV		PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
COV		COV	COV		COV	COV	COV	COV	COV
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)									
SympalB1	0	0	0	0	0	0	0	0	0
Sympmol	0	0	0	0	0	0	0	0	0
Ulexcur	0	0	0	0	0	0	0	0	0
Myosdis	0.333	0.167	0.333	0.167	0.222	0.722	0.429	0.214	0.5
Airacar	0	0	0.333	0.778	0.111	0.667	0.429	1	0.214
Brontec	0.333	0.167	0.222	2.056	0.222	0.722	0	0	0.063
Selawal	0.333	2	0.111	0.056	0.222	0.722	0.286	0.143	0.375
Sielmed	0	0	0.222	0.722	0.667	3.5	0.286	0.143	1.656
Monper	0	0	0.222	0.722	0.111	2	0	0	2.406
Veroser	0.333	0.167	0.667	0.333	0.333	0.167	0.429	0.214	0.156
Melissub	0.333	0.167	0.222	2.056	0.111	0.056	0.143	0.071	0.844
Lomaur	0	0	0.111	0.056	0.111	0.667	0.143	0.071	0.125
Osmochi	0	0	0.111	0.667	0.111	0.667	0.429	1	0.063
Erytore	0	0	0	0	0.111	0.667	0.143	5.429	0.375
Picecon	0	0	0	0	0	0	0.143	0.071	0.813
Monipar	0	0	0	0	0	0	0.286	0.143	0.375
Vicame	0	0	0	0	0.111	0.056	0.143	0.071	0.438
Camagua	0	0	0.111	0.667	0.222	4.278	0.143	2.571	0.375
Dodehen	0	0	0.222	0.111	0.222	0.111	0.429	1	0.063
Tritolg	0	0	0.222	0.722	0.111	0.056	0.286	2.643	0.375
Polygly	0	0	0	0	0.286	0.143	0.071	0.036	0.438
Fesidah	0	0	0.333	0.778	0.222	2.667	0.571	4.357	0.094
Alliter	0	0	0	0	0	0	0	0	0.063
Lathnev	0	0	0	0	0.222	2.667	0.143	2.571	0.75
Arcamac	0	0	0	0	0	0	0.143	0.071	0
Collpur	0.333	0.167	0.222	0.111	0.111	0.056	0.143	0.071	0.125
Crepmod	0.333	0.167	0	0	0.111	0.056	0	0	0.063
Fridan	0	0	0	0	0.222	0.722	0.286	0.929	0.063
Ertolan	0.333	0.167	0.111	0.667	0.111	0.056	0	0	0.063

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file = 934-C50.xls	file = 934-C21.xls	file = 934-C23.xls	file = 934-c31e.xls	file = 934-c29a.xls	file = 934-c28b.xls	file = 934-c28a.xls	file = 934-c30.xls	file = 934-c49.xls							
	OAK- RHAC CAN- FEST BROM S.C.	OAK- CYNO ECH LATE S.	OAK- BROM STER N=9	OAK- ANTHO ODOR N=7	OAK- POA PRAT N=14	OAK- DACT GLOM- BROM CAR S.C. N=5	OAK- DACT GLOM- TYPIC N=16	OAK- DACT GLOM- ARRH ELA S.C. N=5	OAK- DACT GLOM- AGRO STO S.C. N=5							
	PRES AV COV	PRES AV COV	PRES AV COV	PRES AV COV	PRES AV COV	PRES AV COV	PRES AV COV	PRES AV COV	PRES AV COV							
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)																
Heucmic	0	0	0	0	0	0	0	0	0							
Sherarv	0	0	0	0.111	0.667	0	0.143	0.857	0	0.188	0.094	0	0	0.4	1.3	
Plyeri	0.333	0.167	0	0.111	0.667	0	0	0	0.2	0.1	0.25	0.125	0	0	0	
Nemopar	0	0	0.111	0.667	0.222	4.278	0	0	0.214	0.5	0.375	3.063	0	0	0	
Scduspa	0.333	2	0.111	0.056	0.222	0.111	0.143	0.071	0	0	0.188	0.094	0	0	0	
Polymun	0	0	0	0	0.111	0.056	0.143	0.071	0.071	0.036	0	0	0.125	0.063	0	
Teesnud	0	0	0.111	0.056	0	0	0	0	0.214	0.107	0.063	0.031	0	0	0	
Stelnit	0	0	0	0	0	0	0	0	0.063	0.031	0	0.167	0.083	0	0	
Adenbic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Agroaeq	0	0	0	0	0	0	0	0	0.063	1.125	0.167	3	0	0	0	
Agrosti	0	0	0	0	0	0	0	0	0.125	0.406	0	0	0	0	0	
Aira	0	0	0	0	0	0	0.143	0.071	0	0	0	0	0	0	0	
Alliacu	0	0	0.333	0.167	0.333	0.167	0.286	0.143	0.071	0.429	0	0	0.125	0.063	0	
Allioflr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Allivia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Alopecu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Anteneg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Arbglia	0	0	0	0	0.333	0.167	0	0	0	0	0	0	0	0	0	
Astecur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Astler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Balsdel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bellper	0	0	0	0	0	0	0.143	0.071	0	0	0.2	0.1	0.063	0.031	0.333	0.167
Braclalb	0.333	6	0	0	0	0	0	0	0	0	0.063	0.375	0	0	0	
Brachyt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bromine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bromrig	0	0	0	0	0.111	0.056	0	0	0.143	0.464	0	0	0.063	1.125	0.167	10.5
Bromus	0	0	0	0	0	0	0	0	0	0	0.063	0.375	0	0	0	
Bromvul	0	0	0	0	0	0	0	0	0.2	0.1	0	0	0	0	0	
Calacil	0	0	0	0	0	0	0	0	0.063	0.031	0	0	0	0	0	
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES																

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	File = 934-C50.xls	File = 934-C71.xls	File = 934-C73.xls	File = 934-c31a.xls	File = 934-c29a.xls	File = 934-c280.xl	File = 934-c28a.xls	File = 934-c30.xls	File = 934-c49.xls
	OAK- RHAC CAN- FEST BROM S. C. N=3 PRES AV COV	OAK- CYNO ECH LATE S. PRES AV COV	OAK- BROM STER PRES AV COV	OAK- ANTHO ODOR N=7 PRES AV COV	OAK- POA PRAT N=14 PRES AV COV	OAK- BROM CAR S. C. N=5 PRES AV COV	OAK- DACT GLOM TYPIC N=16 PRES AV COV	OAK- DACT GLOM- ARRH ELA S. C. N=5 PRES AV COV	OAK- DACT GLOM- AGRO STO S. C. N=5 PRES AV COV
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)									
Capstur	0	0	0	0	0	0	0.063	0.031	0
Cardoif	0	0.111	0.056	0	0	0	0.143	0.071	0
Cardpul	0	0	0	0	0	0	0.143	0.071	0
Carebre	0	0	0	0	0.143	0.071	0	0	0
Carex	0	0	0	0	0	0	0.071	0.036	0
Casthis	0	0	0	0	0	0	0	0	0
Centcya	0	0	0	0	0	0	0	0	0
Cetrari	0	0	0	0	0	0	0	0	0
Chenalb	0	0	0	0	0	0	0	0	0
Chryleu	0	0	0	0	0	0	0	0	0.2
Cirsary	0	0	0	0	0	0	0	0	0.4
Cirsium	0	0	0	0	0	0	0.063	0.031	0
Cirsund	0	0	0	0	0	0	0	0	0
Cirsul	0	0	0	0.111	0.056	0	0.143	0.071	0.2
Cladina	0	0	0	0	0	0	0	0	0
Cladinal	0	0	0	0	0	0	0	0	0
Cladran	0	0	0	0	0	0	0	0	0
Claoeri	0	0.111	0.667	0	0	0	0	0	0
Collern	0	0	0	0	0	0	0.063	0.031	0
Comamb	0	0	0	0	0	0	0	0	0
Coninac	0	0	0	0	0	0	0	0	0
Conipac	0	0.111	0.056	0.111	0.111	0.2	0.214	0.5	0.125
Conium	0	0	0	0	0	0	0.071	1.286	0
Corralo	0	0	0	0	0	0	0	0	0
Cyperri	0	0	0	0	0	0.2	0.063	0.031	0
Cyrtfa	0	0	0	0	0	0	0.125	0.063	0
Daucar	0	0	0	0	0	0	0	0	0
Daugpul	0	0.222	0.111	0	0	0	0.071	0.036	0
Delpmen	0	0.222	0.111	0.111	0.056	0.286	0.143	1.321	0.2
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES									
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.									

	file=934-C30.xls	file=934-C21.xls	file=934-C23.xls	file=934-c31a.xls	file=934-c29a.xls	file=934-c28b.xls	file=934-c28a.xls	file=934-c30.xls	file=934-c49.xls
	OAK- RHAC CAN- FEST BROM S.C.	OAK- CYNO ECH LATE S.	OAK- BROM STER	OAK- ANTHO ODOR	OAK- POA PRAT	OAK- DACT GLOM- BROM CAR S.C.	OAK- DACT GLOM TYPIC	OAK- DACT GLOM- ARRRH ELA S.C.	OAK- DACT GLOM- AGRO STO S.C.
	N=3 PRES AV COV	N=9 PRES AV COV	N=9 PRES AV COV	N=7 PRES AV COV	N=14 PRES AV COV	N=5 PRES AV COV	n=16 PRES AV COV	N=5 PRES AV COV	N=5 PRES AV COV
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)									
Desecus	0	0	0	0	0	0.2	0	0	0
Dicroso	0	0.222	1.333	0	0	0.429	2.571	0.071	0.429
Digipur	0	0	0	0	0	0	0	0	0
Diplosec	0	0	0	0	0	0	0	0	0
Drabver	0	0	0	0	0	0	0	0	0
Drepunc	0	0	0	0	0	0	0	0	0
Endyrom	0	0	0	0	0	0	0	0	0
Epilmin	0	0	0.111	0.056	0	0	0	0	0
Erodic	0	0	0	0.111	0.056	0	0	0.071	0.429
Eurlhore	0	0	0.111	0.667	0	0	0	0.143	2.571
Festmyu	0	0	0	0	0	0	0	0	0
Festoc	0.333	0.167	0	0	0	0.143	0.071	0	0
Festrub	0	0	0	0	0	0.2	1.2	0	0
Festuca	0	0	0	0	0	0	0	0	0
Fragves	0	0	0	0	0	0.143	0.857	0.071	0.036
Fragvir	0	0	0	0	0	0.286	0.143	0	0
Getracar	0	0	0	0	0	0.2	1.2	0.063	0.031
Geraniu	0	0	0	0	0	0	0	0	0
Goedobl	0	0	0	0	0	0	0	0	0
Hiervi	0	0	0	0	0	0	0	0	0
Holdan	0	0.111	0.056	0.333	3.333	0.429	2.714	0.286	5.321
Homalot	0	0	0	0	0	0	0	0	0
Hordmur	0	0	0	0	0	0	0	0.071	0.036
Hypefor	0	0	0	0	0	0	0	0	0
Hypogla	0	0.111	0.056	0	0	0	0	0	0
Isobec	0	0	0	0	0	0	0	0	0
Juncarc2	0	0	0	0.111	0.056	0	0	0	0
Koelmac	0.333	2	0	0	0	0	0	0.063	0.031
Laebie	0	0.111	0.056	0	0	0.2	0.1	0.063	0.031
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES									

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	file = 934-C50.xls	file = 934-C71.xls	file = 934-C73.xls	file = 934-C31a.xls	file = 934-C29a.xls	file = 934-C28b.xls	file = 934-C28a.xls	file = 934-C30.xls	file = 934-C49.xls								
	OAK- RHAC CAN- FEST BROM S.C. N=3 PRES AV COV	OAK- CYNO ECH LATE S. N=9 PRES AV COV	OAK- BROM STER N=9 PRES AV COV	OAK- ANTHO ODOR N=7 PRES AV COV	OAK- POA PRAT N=14 PRES AV COV	OAK- DACT GLOM- BROM CAR S.C. N=5 PRES AV COV	OAK- DACT GLOM TYPIC n=16 PRES AV COV	OAK- DACT GLOM- ARRH ELA S.C. N=5 PRES AV COV	OAK- DACT GLOM- AGRO STO S.C. N=5 PRES AV COV								
FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)																	
Lamiarp	0	0	0.111	0.056	0	0	0.143	0.464	0	0	0.125	0.063	0	0	0		
Lagsecm	0	0	0	0	0	0	0	0	0	0	0.063	0.375	0	0	0		
Lathrap	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Litcol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Linabic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Linadal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Listcor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Lithpar	0	0	0	0	0	0	0	0	0	0	0.063	0.031	0	0	0		
Loiper	0	0	0.222	4.889	0.286	2.643	0.143	0.071	0.4	0.2	0.063	0.031	0.5	5	0.2	7.6	
Loipers	0	0	0	0	0.286	0.929	0	0	0	0	0	0	0	0	0.4	0.2	
Lomanud	0	0	0.111	0.667	0.222	0.111	0	0	0.071	0.036	0	0	0	0	0	0	
Lomatium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	3.6
Lomatri	0	0	0	0	0	0	0.286	0.143	0	0	0.125	0.063	0	0	0	0	0
Lupbic	0	0	0	0	0.111	0.056	0	0	0	0	0	0	0	0	0	0	0
Lupimic	0.333	0.167	0.111	0.056	0	0	0	0	0	0	0	0	0	0	0	0	0
Lupinus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lychalb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lychcor	0.333	0.167	0.111	0.667	0	0	0	0	0	0	0	0	0	0	0	0	0
Lychnis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Madisat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minuuls	0	0	0.111	0.056	0	0	0	0	0	0	0.063	0.031	0	0	0	0	0
Minugul	0	0	0	0	0	0	0.143	0.071	0	0	0.125	0.063	0	0	0	0	0
Momouni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Montia	0	0	0	0	0	0	0	0	0	0	0.063	0.031	0	0	0.2	1.2	0
Monthm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.1	0
Muscbot	0	0	0.111	0.056	0	0	0	0	0	0	0	0	0	0	0	0	0
Narcpse	0	0	0.111	0.667	0.143	0.071	0	0	0	0	0	0	0	0	0	0	0
Orobuni	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orthoca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES																	

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	File = 934-C50.xls	File = 934-C21.xls	File = 934-C23.xls	File = 934-c31a.xls	File = 934-c29a.xls	File = 934-c28b.xl	File = 934-c28a.xls	File = 934-c30.xls	File = 934-c49.xls
	OAK-1	OAK-1	OAK-1	OAK-1	OAK-1	OAK-1	OAK-1	OAK-1	OAK-1
	RHAC CAN-	CYNO ECH	BROM STER	ANTHO ODOR	POA PRAT	BROM CAR S.C.	DACT GLOM	ARRH ELA S.C.	AGRO STO S.C.
	FEST BROM S.C.	LATES.							
	N=3	N=9	N=9	N=7	N=14	N=5	n=16	N=5	N=5
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV	COV
	FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)								
Orlypus	0	0	0	0	0.071	0	0	0	0
Paconia	0	0	0	0	0	0	0	0	0
Panicar	0	0.111	0.667	0.143	0.071	0	0	0	0
Peltbri	0	0	0	0	0	0	0	0	0
Peltigera	0	0	0	0	0	0	0	0	0
Petigai	0	0	0	0.143	0.071	0	0.125	0	0.2
Platuna	0	0	0	0	0.071	0	0.063	0	0.1
Pleusch	0	0	0	0	0	0	0	0	0
Poa ann	0	0	0.111	0.056	0.071	0	0	0	0.2
Poa bul	0	0	0.222	0.111	0.036	0	0	0	0.1
Poa sun	0	0.111	0.056	0	0	0	0.063	0	0
Pollnut	0	0	0	0	0	0	0	0	0
Polygonu	0	0	0	0	0	0	0.063	0	0
Polymun2	0	0	0	0	0	0	0	0	0
Polypil	0	0	0	0	0	0	0	0	0
Polyspe	0	0	0	0	0	0	0	0	0
Potegla	0	0	0	0	0	0	0.063	0	0
Prunvul	0	0	0	0	0	0	0.063	0	0
Pteragu	0	0	0	0	0	0.2	0	0	0
Ranucp	0	0.111	0.667	0.111	0.036	0	0	0	0
Rhachet	0	0	0	0	0.071	0	0	0	0
Rhinceri	0	0	0	0	0.071	0	0.063	0	0
Rhyuri	0	0.111	0.667	0	0.071	0.2	0.188	0	0
Rumeassa	0	0	0	0.143	0.857	0.2	0.125	0	0
Sanicul	0	0	0	0	0	0.2	0	0	0.4
Sanigra	0	0	0	0	0	0	0	0	0
Satadou	0	0	0	0.286	2.643	0.2	0.25	0	0
Saxifit	0	0	0	0	0	0	0	0	0
Sedulan	0	0.111	0.056	0	0	0	0	0.167	0

MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES

Species are designated with the first 4 letters of the genus and the first 3 letters of the species.

	File=934-C50.xls	File=934-C21.xls	File=934-C23.xls	File=934-C31a.xls	File=934-C29a.xls	File=934-C28b.XI	File=934-C28a.xls	File=934-C30.xls	File=934-C49.xls
	OAK- RHAC CAN- FEST BROM S.C.	OAK- CYNO ECH LATE S.	OAK- BROM STER	OAK- ANTHO ODOR	OAK- POA PRAT	OAK- DACT GLOM- BROM CAR S.C.	OAK- DACT GLOM TYPIC	OAK- DACT GLOM- ARRH ELA S.C.	OAK- DACT GLOM- AGRO STO S.C.
	N=3 PRES AV COV	N=9 PRES AV COV	N=9 PRES AV COV	N=7 PRES AV COV	N=14 PRES AV COV	N=5 PRES AV COV	N=16 PRES AV COV	N=5 PRES AV COV	N=5 PRES AV COV
	FIRST ORDER DISTURBANCE COMMUNITIES (NON-BROOM)								
Sedum	0	0.111	0.056	0	0	0	0	0	0
Senecio	0	0	0	0	0	0	0	0	0
Senevol	0	0	0	0	0	0	0	0	0
Sisydou	0	0	0	0	0	0	0	0	0
Smitise	0	0	0	0	0	0	0	0	0
Solanig	0	0	0	0	0	0	0	0	0
Soncarv	0	0.111	0.056	0.111	0.056	0	0	0	0
Stiplem	0.333	0.167	0.444	0.833	0	0	0.063	0.031	0
Thalocce	0	0	0	0	0	0	0	0	0
Tortur	0	0	0	0	0	0	0	0	0
Tragpor	0	0	0	0	0	0.2	0.1	0.167	1
Trietal	0	0	0	0	0	0	0	0	0
Triddep	0	0	0.111	0.667	0	0	0	0	0
Triflyb	0	0	0	0.286	3.429	0.4	0.2	0.167	0.083
Trifmic	0	0	0	0.143	0.071	0	0	0	0
Trifoli	0	0.111	2	0	0	0.071	0.429	0	0
Trifrep	0	0	0.111	0.056	0	0.2	0.1	0.063	0.375
Trifrub	0	0	0	0.143	2.571	0	0	0	0
Trifar	0	0	0	0	0	0	0.063	0.375	0
Triuas	0	0	0	0	0	0	0	0	0
Trilya	0.333	0.167	0.111	0.056	0	0.4	1.3	0.167	0.083
Veroume	0	0	0	0.429	1.786	0	0.188	0.094	0
Veronic	0	0	0	0	0	0	0.063	0.031	0
Vicia	0	0	0	0	0	0	0	0	0
Vicia	0	0	0.111	2	0	0.2	1.2	0.063	0.375
Vincemin	0	0	0	0	0	0	0	0	0
Viopra	0	0	0	0	0.071	0.429	0	0	0
Zigaven	0.333	0.167	0.222	0.722	0.143	0.071	0.125	0.063	0
	MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
	Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-e3.xls	file=934-c17.xls	file=934-C22.xls	file=934-e31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
	OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
	BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
	CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
	LATE S.	AIRA S.C.	AIRA PRA S.C.	S.C.				
	N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
SympalB2	0.167 0.083	0 0	0.667 4	0.5 1.625	0.667 18.67	0.8 5	0.4 13.8	0.667 7.083
Violsat	0.5 2.083	0.5 2.55	0.667 4	0.75 9.125	1 0.5	1 1.6	1 8.6	1 4.333
Trifri	0 0	0.2 0.1	0.333 2	0.75 4.75	0 0	0 0	0 0	0 0
Lotunjc	0.667 0.333	0.2 0.1	0.667 8	0.75 3.125	0 0	0.2 0.1	0 0	0 0
Myosdis	0.5 0.25	0.4 0.2	0 0	0.25 1.5	0.667 0.333	0.4 0.2	0.4 0.2	0 0
Hypprad	0.5 0.25	0.4 0.2	0.333 2	0.5 0.25	0.667 0.333	0.2 0.1	0.4 0.2	0.333 0.167
Daphlau	0.167 0.083	0 0	0 0	0 0	0.667 0.333	0 0	0.4 0.2	0.167 0.083
Plecon	0 0	0 0	0 0	0.25 0.125	0.667 4	0.2 0.1	0 0	0.167 0.083
Rhytri	0.167 10.5	0 0	0 0	0.25 1.5	1 6	0.4 8.8	0.2 1.2	0.167 1
Dodehen	0.5 2.083	0.2 0.1	0 0	0 0	0.667 2.167	0.4 1.3	0.4 3.7	0.333 0.167
Lonthis	0.167 1	0 0	0.333 2	0.5 1.625	0.667 6.167	0.2 1.2	0.2 0.1	0.167 3
Shervr	0 0	0 0	0.333 2	0 0	0.667 0.333	0.2 1.2	0.2 0.1	0.167 3
Teesnud	0.333 0.167	0.1 0.05	0 0	0 0	0.667 2.167	0 0	0 0	0 0
Stelnit	0.167 0.083	0.2 0.1	0 0	0 0	0.667 0.333	0.2 0.1	0 0	0 0
Melsub	0.5 4.083	0.1 0.6	0 0	0 0	0.667 2.167	0.2 3.6	0.4 4.8	0.5 4.083
Geramol	0.5 4.083	0.5 0.8	0.333 0.167	0.5 1.625	0.667 2.167	0.8 0.4	0.6 4.9	0.5 4.083
Bromcar	0.5 1.167	0.3 1.8	0.333 2	0.25 0.125	1 2.333	0.8 3.7	1 9.7	0.833 2.25
Eurhore	0.167 3	0.1 1.8	0 0	0.5 3	0.667 8	0.8 13.6	0.6 12.4	0.167 1
Daeglo	0.333 1.083	0.2 0.65	0 0	0 0	0.667 2.167	0.8 5	1 53	0.5 4.083
Poa pra	0.333 3.083	0.6 1.95	0 0	0.5 6	1 4.167	1 34	1 9.7	0.5 3
Montper	0.5 1.167	0.2 1.85	0.333 0.167	0.5 1.625	1 0.5	0.8 2.6	0.8 3.7	0.667 0.333
Planlan	0 0	0.1 0.05	0 0	0 0	0.667 2.167	0.6 0.3	0.8 3.9	0 0
Vichir	0.667 6.167	0.4 0.2	0.333 2	0.5 1.625	0.667 0.333	0.6 0.3	0.8 12	0.667 11.33
Osmochi	0.167 1	0 0	0 0	0 0	0 0	0.2 0.1	1 10.8	0.167 1
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-	OAK-
BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-	BROOM-
CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHIO ODOR	POA PRAT	DACT GLOM	ELYM GLAU	
LATE S.	ALRA S.C.	ALRA PRA S.C.	S.C.					
N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6	
PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	
COV	COV	COV	COV	COV	COV	COV	COV	
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Nemopar	0.167	0.083	0.1	0.05	0.333	0.167	0	0
Polymun	0.333	0.167	0	0	0	0	0.8	1.5
Quergara	0.667	30.33	0.5	18.8	0	0	0.8	1.5
QuergarB1	0.833	33.33	0.7	21.9	1	27.33	0.4	25.2
QuergarB2	0.667	6	0.7	7.9	1	8.167	1	73
Quergard	0.333	0.167	1	2.8	0.667	4	0.4	8.8
Pseumena	0.167	6.333	0	0	0	0	0.6	2.5
PseumenB1	0.167	1	0	0	0	0	0.6	0.3
PseumenB2	0.167	0.083	0.1	0.05	0	0	0.6	1
Pseumend	0	0	0	0	0	0	0.2	0.167
Abiegrab1	0	0	0	0	0	0	0.2	1.2
Abiegrab2	0	0	0	0	0	0	0.2	1.2
Abiegrad	0	0	0	0	0	0	0.2	1.2
Acermaca	0	0	0	0	0	0	0.2	1.2
AcermacB1	0	0	0	0	0	0	0.2	1.2
AcermacB2	0	0	0	0	0	0	0.2	1.2
AcermacD	0.167	0.083	0	0	0	0	0.2	0.1
Arbumena	0.167	1	0	0	0	0	0.2	0.1
ArbumenB1	0.167	1	0	0	0.333	2	0	0
ArbumenB2	0.167	1	0.2	0.65	0.333	6	0	0.167
Arbumend	0	0	0	0	0	0.333	0	0.167
Juniscoa	0	0	0	0	0	0	0	0
JuniscoB1	0	0	0	0	0	0	0	0
JuniscoB2	0	0	0	0	0	0	0	0
PinuponB1	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-	OAK-
BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-	BROOM-
CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTH O ODOR	POA PRAT	DACT GLOM	EL YM GLAU	
LATE S.	AIRA S.C.	AIRA PRA S.C.	S.C.					
N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6	
PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	
COV	COV	COV	COV	COV	COV	COV	COV	
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Rubbuurs	0	0	0.333	0.167	0	0	0.4	1.3
Oemleer	0	0	0	0	0.333	0.167	0.4	1.3
OemleerB2	0	0	0	0	0	1.2	0.2	0.1
Rosanubi	0	0	0	0	0	0	0	0
Rossanut	0	0	0	0	0	0	0.2	1.2
Hedehe/EP	0	0	0	0	0	0	0	0
Hedehe/B1	0	0	0	0	0	0	0	0
Hedehe/B2	0	0	0	0	0	0	0	0
Lonicil/B1	0	0	0	0	0	0	0	0
Lonicil	0	0	0	0	0.333	6	0	0
Holodis/B1	0	0	0	0	0	0	0	0.167
Holodis/B2	0.167	1	0.1	0.05	0	0	0.2	0.1
Lonithis/B1	0	0	0	0	0	0	0	0
Amelaln/B1	0	0	0	0	0	0	0	0
Amelaln	0	0	0.333	2	0	0	0.2	1.2
Arcticol	0	0	0	0	0	0	0	0
Arctiva	0	0	0	0	0	0	0	0
Comser/B1	0	0	0	0	0	0	0	0
Comser/B2	0	0	0	0	0	0	0	0
Craetegu	0	0	0	0	0	0	0	0
Craidou/B1	0	0	0	0	0	0	0	0
Craidou/B2	0	0	0	0	0	0	0	0
Craunon/B1	0	0	0	0	0	0	0	0
Craunon/B2	0	0	0	0	0	0	0.2	0.1
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
	OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
	BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
	CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
	LATE S.	AIRA S.C.	AIRA PRA S.C.	S.C.				
	N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Gaulsha	0	0	0	0	0	0	0	0
Ilexeur	0	0	0	0	0	0	0	0
DexeurB2	0	0	0	0	0	0	0	0
LychalB2	0	0	0	0	0	0.2	1.2	0
MahoaquB1	0	0	0	0	0	0	0	0
Mahoner	0	0	0	0	0	0	0.2	0.1
Malus	0	0	0	0	0	0	0	0
Coloneas	0	0	0	0	0	0	0	0
Paximyr	0	0	0	0	0	0	0	0
PhillewB1	0	0	0	0	0	0	0	0
PhillewB2	0	0	0	0	0	0	0	0
PhyscapB1	0	0	0	0	0	0	0	0
PrunemaB1	0	0	0	0	0	0	0.2	0.1
PrunemaB2	0	0	0	0	0	0	0	0
PrunusB1	0	0	0	0	0	0	0	0
Prunvir	0	0	0	0	0	0	0	0
PrunvirB2	0	0	0	0	0	0	0	0
RhampurB1	0	0	0	0	0	0	0	0
Rhampur	0	0	0	0	0	0.2	0.1	0
Rosa	0	0	0	0	0	0	0	0
Rosagym	0.167	0.083	0	0	0	0	0	0.167
Rosapis	0	0	0	0	0	0	0	0
Rubupro	0	0	0	0	0	0.2	0.1	0
RubuproB1	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file = 934-C2.xls	file = 934-c3.xls	file = 934-c17.xls	file = 934-C22.xls	file = 934-c31B.xls	file = 934-C4.xls	file = 934-C5.xls	file = 934-C6.xls
	OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
	BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
	CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
	LATE S.	ADRA S.C.	ADRA PRA S.C.	S.C.				
	N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Rubulac	0	0	0	0	0	0	0	0
Rubuleu	0	0	0	0	0	0	0.2	0.1
Sambrac	0	0	0	0	0	0	0	0
Spiridou	0	0	0	0	0	0	0.2	0.1
Sympalbb1	0	0	0	0	0	0	0	0
Sympmol	0	0	0	0	0	0	0	0
Ulexeur	0	0	0	0	0	0	0	0
Careino	0.333	0.2	0.333	0.5	0.333	0.6	0.4	1.9
Achimil	0.5	0.4	0.333	0.25	0	0.6	0	0.5
Lomaur	0.333	0.2	0.333	0.25	0.333	0	0	0.5
Cerarr	0.5	0.4	0.333	0.25	0.333	0.2	0.2	0.667
Erylore	0	0	0	0.25	0.333	0.4	0.2	0
Monthar	0	0.1	0.333	0	0	0	0.2	0.167
Viciame	0.167	0	0.333	0	0	0.2	0.4	0.2
Camagua	0.167	0.1	0	0.25	0.333	0.2	0	0.167
Ranuoce	0.5	0	0	0	0.333	0.4	0.2	0.1
Taroff	0	0	0	0	0.333	0.1	0.2	0.1
Trifolg	0.333	0.1	0	0	0	0	0	0
Polygly	0	0.4	0.333	0.25	0	0	0	0.167
Festidah	0.167	0.1	0.333	0.25	0.333	0.4	0.2	0
Trfnrc	0.333	0.2	0.333	0.25	0.333	0	0	0.167
Trfdub	0	0	0	0.25	0	0.4	0.2	0.1
Arthela	0	0	0	0	0	0	0	0
Allieer	0	0	0	0	0.333	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
	OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
	BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
	CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
	LATE S.	AIRA S.C.	AIRA PRA S.C.	S.C.				
	N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Lathnev	0	0	0	0	0	0	0.2	0.1
Agrosti	0	0	0	0	0	0	0	0
Arenmac	0.167	0.083	0	0.25	0.125	0.333	0.167	0.2
Claramo	0.167	0.083	0.1	0.05	0	0	0	0
Dantcal	0.333	4	0	0	0	0	0	0
Crepmod	0.333	0.167	0	0	0.333	0.167	0	0
Frillan	0	0	0.1	0.05	0	0	0	0
Eriolan	0.333	0.167	0	0	0.333	0.167	0.2	1.2
Heuemie	0.167	0.083	0	0	0	0	0	0
Pityiri	0	0	0.1	0.05	0.333	0.167	0	0
Seduspa	0.167	0.083	0.2	0.65	0.333	0.167	0.25	0.125
Adenbic	0	0	0	0	0	0	0	0.2
Agroaeq	0	0	0	0	0	0	0	0
Agrosti	0	0	0	0	0	0	0	0
Aira	0	0	0	0	0	0	0	0
Alliacu	0.667	0.333	0.4	0.75	0.333	0.167	0.25	0.125
Allioff	0	0	0	0	0	0	0	0
Allivin	0	0	0	0	0	0	0	0
Alopeeu	0	0	0	0	0	0	0	0
Anteneg	0	0	0	0	0	0	0	0
Arabgla	0.167	0.083	0.1	0.05	0	0	0	0.167
Astecur	0	0	0	0	0	0	0	0
Aster	0	0	0	0	0	0	0	0
Balsdel	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
	OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
	BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
	CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
	LATE S.	AIRA S.C.	AIRA PRA S.C.	S.C.				
	N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Bellper	0	0	0	0	0.333	0.167	0	0.2
Brachalb	0.167	1	0	0	0	0.2	1.2	0
Brachyt	0.167	1	0	0	0	0	0	0
Bromine	0	0	0	0	0	0	0	0
Broming	0.167	1	0.2	3.6	0	0	0	0.333
Bromus	0	0	0	0	0	0	0	0
Bromvul	0	0	0	0	0	0	0.2	0.1
Calacil	0	0	0	0	0	0	0	0
Capstur	0	0	0	0	0	0.2	0.1	0
Cardoli	0.167	0.083	0	0	0.333	0.167	0	0
Cardpul	0	0	0	0	0	0	0	0
Carebrev	0	0	0	0	0	0	0	0
Carex	0	0	0	0	0	0	0	0
Casthis	0	0	0	0	0	0	0	0.167
Centeya	0	0	0	0	0	0	0	0.167
Cetrari	0	0	0	0	0	0	0	0
Chenalb	0	0	0	0	0	0	0	0
Chryleu	0	0	0	0	0	0	0	0
Cirsarv	0	0	0	0	0	0	0	0
Cirsium	0	0	0	0	0	0	0	0
Cirsul	0.167	0.083	0	0	0	0	0.2	0.1
Cladina	0	0	0	0	0	0	0	0
Cladinal	0	0	0	0	0	0	0	0
Cladran	0	0	0.333	2	0	0.333	2	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	File = 934-C2.xls	File = 934-c3.xls	File = 934-c17.xls	File = 934-C22.xls	File = 934-c31B.xls	File = 934-C4.xls	File = 934-C5.xls	File = 934-C6.xls
OAK-		O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-	BROOM-
CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU	
LATE S.	AIIRA S.C.	AIIRA PRA S.C.	S.C.					
N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6	
PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	
COV	COV	COV	COV	COV	COV	COV	COV	
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Clacori	0	0	0	0	0	0	0	0
Collera	0	0	0	0	0	0	0	0
Comaumb	0	0	0	0	0	0	0	0.167 0.083
Continac	0	0	0	0	0	0	0	0
Conipae	0	0	0	0	0	0	0	0
Conium	0	0	0	0	0	0.4	4.8	0
Corralo	0	0	0	0	0.333 0.167	0	0	0
Crypteri	0	0	0.333 0.167	0	0	0	0	0
Cystfra	0	0	0	0	0	0.2	0.1	0
Daucar	0	0	0	0	0	0	0	0
Daucpul	0	0	0.333 0.167	0	0	0	0	0
Delpmen	0.167 0.083	0	0	0.25 0.125	0.667 0.333	0.2 1.2	0	0
Descses	0	0	0	0	0	0	0	0
Diersco	0.167 1	0.4 3.6	0.333 2	0	0.333 12.67	0.2 1.2	0.2 1.2	0.167 1
Digipur	0	0	0	0	0	0	0	0
Diplose	0	0	0	0	0	0	0	0
Draber	0	0	0	0	0	0	0	0
Drepunc	0	0	0	0	0	0	0	0
Endynon	0	0	0	0	0	0	0	0
Epilmin	0.167 0.083	0.1 0.05	0.333 0.167	0	0	0	0	0
Etodeic	0	0.1 0.05	0	0	0	0	0	0
Festmyu	0	0.3 4.2	0	0	0	0	0	0.167 0.083
Festocce	0.167 0.083	0	0.333 2	0	0	0	0	0
Festrub	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
	OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
	BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
	CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
	LATE S.	AIIRA S.C.	AIIRA PRA S.C.	S.C.				
	N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Festuca	0	0	0	0	0	0.2	0.1	0
Fragves	0	0	0	0	0	0	0	0
Fragvir	0	0	0	0	0	0	0	0
Geracar	0	0	0	0	0	0	0	0
Geranium	0	0	0	0	0	0	0	0
Goodobl	0	0	0	0	0	0	0	0
Hierali	0	0	0	0	0	0	0	0
Holclan	0.167	0.083	0.1	0.05	0	0.2	0.1	0.4
Homalot	0	0	0	0	0	0	0	0
Hardmur	0.167	0.083	0	0	0	0	0	0
Hypedor	0	0	0	0	0	0	0	0
Isothec	0	0	0	0	0	0	0	0
Juncarc2	0.167	0.083	0	0	0	0	0	0
Koelmac	0	0	0	0	0	0	0.2	0.1
Lactbic	0	0	0	0	0	0	0.4	0.2
Lantiamp	0	0	0	0	0	0	0	0.167
Lapscor	0	0	0	0	0	0	0	0
Lathjap	0	0	0	0	0	0	0	0
Lathyrus	0	0	0	0	0	0	0	0
Lilicol	0	0	0	0	0	0	0	0
Linabic	0.167	0.083	0	0	0	0	0	0
Linadal	0	0	0	0	0	0	0	0
Listcor	0	0	0	0	0	0	0	0
Lithpar	0	0	0	0	0.25	0.125	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
OAK-		O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
BROOM-		RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
CYNO ECH		FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
LATE S.		AIRA S.C.	AIRA PRA S.C.	S.C.				
N=6		N=10	N=3	N=4	N=3	N=5	N=5	N=6
PRES AV		PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
COV		COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Loliper	0	0	0	0	0	0	0	0
Loliprs	0	0	0	0	0	0	0	0
Lomanud	0	0	0	0	0	0	0	0
Lomatium	0	0	0	0	0	0	0	0
Lomatri	0	0	0	0	0.667	2.167	0.2	1.2
Lupibie	0	0	0	0.25	0.125	0	0	0
Lupimic	0	0	0	0	0	0	0	0
Lupinus	0	0	0	0.25	0.125	0	0	0
Lychalb	0	0.1	0.05	0.333	0.167	0	0	0
Lycheor	0	0	0	0	0	0	0	0
Lychnis	0.167	0.083	0	0	0	0	0	0
Madisat	0	0	0	0	0	0	0	0
Mimuals	0	0	0.333	0.167	0	0	0	0
Mimugut	0	0	0	0	0	0	0	0
Monouni	0	0	0	0	0	0	0.2	0.1
Montia	0	0	0	0	0	0	0	0
Montin	0	0	0	0	0	0	0	0
Muschot	0	0	0	0	0	0	0	0
Narcyse	0	0	0	0.25	0.125	0	0	0
Orobuni	0	0	0	0	0	0	0	0
Orthoca	0	0	0	0	0	0	0	0
Orthus	0	0	0	0	0	0	0	0
Paeonla	0	0	0	0	0	0	0	0
Panicst	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	file=934-C2.xls	file=934-c3.xls	file=934-c17.xls	file=934-C22.xls	file=934-c31B.xls	file=934-C4.xls	file=934-C5.xls	file=934-C6.xls
OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-	OAK-
BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-	BROOM-
CYNO ECH	FEST BROM-	RHAC CAN-	BROM TFC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU	
LATE S.	AIRA S.C.	AIRA PRA S.C.	S.C.					
N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6	
PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	
COV	COV	COV	COV	COV	COV	COV	COV	
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Pelttri	0	0	0	0	0	0	0	0
Pelligera	0	0	0	0	0	0	0	0
Perigai	0	0	0	0	0	0	0	0
Platura	0	0	0	0	0.333	0.167	0.2	0.1
Pleusch	0	0	0	0	0	0	0	0.167
Poa ann	0	0	0	0	0	0	0	0
Poa bul	0	0.1	0.05	0	0	0	0.2	0.1
Poa san	0.167	0.2	0.1	0.333	0.167	0	0	0
Pohlmut	0	0	0	0	0	0	0	0
Polygon	0	0	0	0	0	0	0	0
Polygon2	0	0	0	0	0	0	0	0
Polypil	0	0	0	0	0	0	0	0
Polyspe	0	0	0	0	0	0	0	0
Potegla	0	0	0	0	0	0	0	0
Prunvul	0	0	0	0	0	0	0	0
Pteragu	0	0	0	0	0	0	0	0
Ranurep	0	0	0	0	0	0	0	0
Rhachet	0	0.1	0.6	0.5	3	0	0	0
Rhineri	0	0	0	0	0	0	0	0
Rumeosa	0.167	1	0	0	0	0	0	0
Sanicul	0	0	0	0	0	0	0	0
Sanigra	0.167	0.083	0	0	0	0	0	0
Satudou	0.167	1	0	0	0	0	0	0.333
Saxint	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	File=934-C2.xls	File=934-c3.xls	File=934-c17.xls	File=934-C22.xls	File=934-c31B.xls	File=934-C4.xls	File=934-C5.xls	File=934-C6.xls
	OAK-	O-BROOM-	OAK-	O-BROOM-	OAK-	OAK-	OAK-	OAK-
	BROOM-	RHAC CAN-	BROOM-	RHAC CAN-	BROOM-	BROOM-	BROOM-	BROOM-
	CYNO ECH	FEST BROM-	RHAC CAN-	BROM TEC	ANTHO ODOR	POA PRAT	DACT GLOM	ELYM GLAU
	LATE S.	ALRA S.C.	ALRA PRA S.C.	S.C.				
	N=6	N=10	N=3	N=4	N=3	N=5	N=5	N=6
	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV	PRES AV
	COV	COV	COV	COV	COV	COV	COV	COV
SECOND ORDER DISTURBANCE COMMUNITIES: BROOM SERIES								
Sedulan	0	0	0.333	0.167	0	0	0	0.167
Sedum	0	0	0	0	0	0	0	0
Senecio	0	0	0	0	0	0	0	0
Senewul	0	0.1	0.05	0	0	0	0	0
Sherarv	0	0	0.333	0.167	0	0	0	0
Silegal	0	0	0	0	0	0	0	0
Silencec	0	0	0	0	0	0	0	0.167
Sisydou	0	0	0.333	2	0	0	0	0
Smliste	0	0	0	0	0	0	0	0
Solanig	0	0	0	0	0	0	0	0
Soncarv	0.333	0.167	0	0	0	0	0	0
Stiplem	0.167	1	0.2	0.1	0.333	2	0	0
Thalocc	0	0	0	0	0	0	0	0
Tortnur	0	0	0	0	0	0	0	0
Tragpor	0	0	0	0	0	0	0	0
Trielat	0	0	0	0	0	0	0	0
Trifdep	0	0	0	0.25	1.5	0	0	0
Triflyb	0	0	0	0	0	0	0	0
Trifmic	0	0	0	0	0	0	0	0
Trifoli	0	0	0	0	0	0	0	0
Trifrep	0	0	0	0	0	0	0	0
Trifrub	0	0	0	0	0	0	0	0
Trifar	0	0	0	0	0	0	0	0
Trifas	0	0	0	0	0	0	0	0
MEAN PRESENCE FOLLOWED BY COVER FOR SHRUBS HERBS AND MOSS LAYER SPECIES								
Species are designated with the first 4 letters of the genus and the first 3 letters of the species.								

	PLOT /	GENUS	SPECIES	COMENTS	EQUIVALENT*	
	COLLECTION				GENUS	SPECIES
94R	Blundell Is	Achillea	millefolium	REC. - 940518		
94R	PE01-3	Agoseris	glauc			
93R	HE01-1	Agrostis	sp.	aequalivalvis ?- tbd		
94R	MA02-1	Agrostis	sp.	aequalivalvis ?- tbd		
93R	NB03-2	Agrostis	sp.	aequalivalvis ?- tbd		
93R	UP01-1	Agrostis	sp.	aequalivalvis ?- tbd		
94R	GLA07-1	Agrostis	stolonifera		Agrostis	gigantea
93R	JdF02-4	Agrostis	stolonifera		Agrostis	gigantea
93R	NH02-2	Agrostis	stolonifera		Agrostis	gigantea
93R	SX01-	Agrostis	stolonifera		Agrostis	gigantea
93R	WL01-1	Agrostis	stolonifera		Agrostis	gigantea
93R	MH03-7	Aira	caryophylla		Agrostis	gigantea
93R	SH05-OP/OH	Aira	caryophylla			
93R	AHP01-1	Aira	praecox			
93R	BHP03-1	Aira	praecox	inclusion		
93R	BHP03-4A	Aira	praecox			
93R	GB01-2	Aira	praecox			
94R	MA03-4	Aira	praecox			
94R	MD03C	Aira	praecox			
93R	MH03-5	Aira	praecox			
93R	UP04-4	Aira	praecox			
93R	PP01-12	Aira	praecox			
93R	AHP01-4	Alchemilla	occidentalis		Aphanes	occidentalis
93R	Bear Hill	Alchemilla	occidentalis	RECONN.	Aphanes	occidentalis
93R	GB02-4B	Alchemilla	occidentalis		Aphanes	occidentalis
94R	GLA02B-3	Alchemilla	occidentalis		Aphanes	occidentalis
93R	JdF05-1	Alchemilla	occidentalis		Aphanes	occidentalis
93R	NB02-3	Alchemilla	occidentalis		Aphanes	occidentalis
93R	SA04-1	Alchemilla	occidentalis		Aphanes	occidentalis
93R	SA08-5	Alchemilla	occidentalis	inclusion	Aphanes	occidentalis
93R	BHP02B-1	Alliaria	officinalis		Alliaria	petiolata
93R	NB06-6	Allium	acuminatum			
93R	TZ01-2	Allium	acuminatum			
94R	Blundell Is	Amelanchier	alnifolia	REC. - 940518		
93R	SS08-OP/OH	Antennaria	neglecta			
93R	BHP03-4B	Anthoxanthum	odoratum			
93R	NH01	Anthoxanthum	odoratum			
93R	SG01-1	Anthoxanthum	odoratum			
93R	NB01-1	Arabis	glabra			
93R	JdF03-6	Arenaria	macrophylla		Moehringia	macrophylla
93R	PP01-15	Arenaria	macrophylla		Moehringia	macrophylla
94R	NA04-1	Arrhenatherum	elatius			
93R	UP04B	Arrhenatherum	elatius	930517		
94R	TH06-1	Aster	sp.	("ciliolatus")		
93R	MF01-1	Barbarea	vulgaris			
93R	PP03-1	Barbarea	vulgaris			
94R	GALI11-1	Brachythecium	?			
94R	OH05-1	Brachythecium	?			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT /	GENUS	SPECIES	COMENTS	EQUIVALENT*	
	COLLECTION				GENUS	SPECIES
94R	FR01B-2	Brachytheceium	albicans			
94R	GAL106-1	Brachytheceium	albicans			
94R	GLA03B-4	Brachytheceium	albicans			
93R	GZ01-1	Brachytheceium	albicans			
93R	JdF02-1	Brachytheceium	albicans			
93R	JdF02-4	Brachytheceium	albicans	inclusion		
93R	JdF04-3	Brachytheceium	albicans	inclusion		
93R	OH05-1	Brachytheceium	albicans			
94R	PE03-1	Brachytheceium	albicans			
94R	PI01-1	Brachytheceium	albicans			
93R	SA08-5	Brachytheceium	albicans			
94R	TH03-5	Brachytheceium	albicans			
93R	TZ02-1	Brachytheceium	albicans			
93R	UP09-2	Brachytheceium	sp.			
93R	BHP03-1	Brachytheceium	sp.			
93R	NB04-1	Brachytheceium	sp.			
93R	BHP02-1	Brachytheceium	sp.			
93R	BHP01-2	Brodiaea	coronaria			
94R	GAL101-2	Brodiaea	coronaria			
93R	GB02-13	Brodiaea	coronaria			
93R	HE01-2	Brodiaea	coronaria			
93R	Helliwell	Brodiaea	coronaria	RECONN.		
93R	JdF02-2	Brodiaea	coronaria			
93R	JdF03-8	Brodiaea	coronaria			
93R	NB02-5	Brodiaea	coronaria			
93R	NH03-3	Brodiaea	coronaria			
94R	PE09-1	Brodiaea	coronaria			
93R	PP01-1	Brodiaea	coronaria			
93R	Saltspring I.	Brodiaea	coronaria	RECONN.		
93R	SS19	Brodiaea	coronaria			
94R	The Bluffs	Brodiaea	coronaria	RECONN		
93R	Thimble Farms	Brodiaea	coronaria	RECONN.		
93R	PP03-3	Brodiaea	coronaria			
93R	AHP01-7	Bromus	carinatus		930426	
93R	BHP01-1	Bromus	carinatus			
93R	BHP01B-1	Bromus	carinatus			
94R	CA01-1	Bromus	carinatus			
94R	GAL102-2	Bromus	carinatus			
93R	GB02	Bromus	carinatus			
93R	GB03-4	Bromus	carinatus			
93R	GI01-1	Bromus	carinatus			
93R	GLA06-2	Bromus	carinatus			
93R	GZ01B	Bromus	carinatus			
93R	High Salal	Bromus	carinatus	RECONN.		
93R	High Salal	Bromus	carinatus	RECONN.		
94R	MA01-1	Bromus	carinatus			
94R	MD01C-1	Bromus	carinatus			
94R	NA01-2	Bromus	carinatus			
93R	NB01-1	Bromus	carinatus			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT /	GENUS	SPECIES	COMENTS	EQUIVALENT*	
	COLLECTION				GENUS	SPECIES
94R	PA02-1	Bromus	carinatus			
94R	PE01-4	Bromus	carinatus			
94R	PE07-1	Bromus	carinatus			
94R	PE08-2	Bromus	carinatus			
94R	PE10	Bromus	carinatus			
93R	PP03-OP	Bromus	carinatus			
94R	RP03-2	Bromus	carinatus			
94R	RP04-1	Bromus	carinatus			
93R	SA01-OP	Bromus	carinatus			
93R	SS04-1	Bromus	carinatus			
93R	SX02-2	Bromus	carinatus			
94R	TH03-1	Bromus	carinatus			
94R	UV02-1	Bromus	carinatus			
94R	UV02-2	Bromus	carinatus			
93R	Woodscnd Dr.	Bromus	carinatus	RECONN.		
93R	JdF03-4	Bromus	commulatus			
93R	James Bay	Bromus	inermis	RECONN.		
94R	NA01	Bromus	inermis			
94R	Panama Hill	Bromus	inermis	RECONN		
93R	CO03	Bromus	mollis		Bromus	hordeaceus
93R	GB02-23	Bromus	mollis		Bromus	hordeaceus
93R	JdF05-OP	Bromus	mollis		Bromus	hordeaceus
93R	MD02	Bromus	mollis		Bromus	hordeaceus
93R	MH03-10	Bromus	mollis		Bromus	hordeaceus
94R	NA01-OP	Bromus	mollis		Bromus	hordeaceus
94R	Observ. H.	Bromus	mollis	RECONN.	Bromus	hordeaceus
94R	PE02-2	Bromus	mollis		Bromus	hordeaceus
93R	SA02-3	Bromus	mollis		Bromus	hordeaceus
94R	YE07-6	Bromus	mollis		Bromus	hordeaceus
94R	RP02-1	Bromus	pacificus			
93R	AHP01B	Bromus	rigidus			
94R	GALI01-1	Bromus	rigidus			
93R	GZ01B-2	Bromus	rigidus			
94R	MD01C-4	Bromus	rigidus			
94R	NA01-OP	Bromus	rigidus			
93R	NB02-6	Bromus	rigidus			
93R	OH01-1	Bromus	rigidus			
93R	UP04-10	Bromus	rigidus			
94R	YE09-2?	Bromus	rigidus			
94R	GALI04-4	Bromus	sterilis			
93R	James Bay	Bromus	sterilis	RECONN.		
93R	JdF02-OP	Bromus	sterilis			
93R	JdF03-2	Bromus	sterilis			
93R	MD01&2	Bromus	sterilis			
94R	MD01C-5	Bromus	sterilis			
94R	NA01-OP	Bromus	sterilis			
93R	NB04-4	Bromus	sterilis			
94R	PE01-5	Bromus	sterilis			
93R	UP07-1	Bromus	sterilis			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
93R	JdF02-5	Bromus	tectorum			
93R	JdF02-OP	Bromus	tectorum			
93R	JdF03-3	Bromus	tectorum			
93R	MH03-9	Bromus	tectorum			
94R	Observ. H.	Bromus	tectorum	RECONN		
94R	PE04-2	Bromus	tectorum			
94R	PE09-2	Bromus	tectorum			
93R	SG01-2	Bromus	tectorum			
93R	SS12-OP	Bromus	tectorum			
93R	UP05-2	Bromus	tectorum			
93R	KH04-1	Bromus	vulgaris			
93R	SS04-2	Bromus	vulgaris			
93R	GB02-5	Calandrinia	ciliata			
93R	MD03	Calandrinia	ciliata			
94R	GLA087-3	Camassia	leichtlinii			
94R	KH01B-1	Camassia	leichtlinii			
94R	GALI01-3	Camassia	quamash			
93R	HE01-2	Camassia	quamash			
93R	JdF03-9	Camassia	quamash			
93R	NB02-6	Camassia	quamash			
93R	NB04-3	Camassia	quamash			
94R	SU01B-1	Camassia	quamash			
94R	TH05-1	Camassia	quamash			
93R	Thimble Farms	Camassia	quamash	RECONN.		
93R	TZ03-1	Camassia	quamash			
93R	UP05-4	Camassia	quamash			
94R	Cairn Pk ?	Cardamine	oligosperma	RECONN.		
93R	GB02-14	Cardamine	oligosperma			
93R	James Bay	Cardamine	oligosperma	RECONN.		
93R	HE01	Carex	inops			
93R	BHP03-2	Carex	inops			
93R	NB04-2	Carex	inops			
93R	SP01-3	Carex	inops			
93R	SS12	Carex	praticola			
94R	Panama Hill	Carex	simulata	RECONN.		
94R	Blundell Is	Castilleja	hispida	REC. - 940518		
93R	SA01-OP/OH	Castilleja	hispida			
94R	GALI14-2	Caucalis	microcarpa			
93R	SS11	Caucalis	microcarpa			
94R	YE07-1	Caucalis	microcarpa			
93R	KH01-2	Centaurea	cyanus			
94R	Blundell Is	Cerastium arvense		REC. - 940518		
94R	GALI05-1	Cladina	portentosa			
93R	NB03-3	Cladina	portentosa			
94R	PI02-1	Cladina	portentosa			
93R	PP01-9	Cladina	portentosa			
93R	SA03-5	Cladina	portentosa			
94R	PI01-2	Cladina	rangiferina			
94R	Blundell Is	Cladina		REC. - 940518		

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
93R	CO03-1	Cladina				
93R	PP01-5	Cladina				
94R	MA03-1	Clarkia	amoena			
94R	GLA03B-OP	Collinsia	parviflora			
93R	LP01-2	Collinsia	parviflora			
93R	MH03-2	Collinsia	parviflora			
94R	TH02-2	Collinsia	parviflora			
94R	WO01-1	Collomia	heterophylla			
93R	MH01-1	Comandra	umbellata			
93R	MH01-2	Comandra	umbellata			
94R	FR01B-3	Conioselinum	pacificum			
93R	SX01-3	Conioselinum	pacificum			
93R	ES03-1	Conioselinum	pacificum			
94R	SU05-1	Conium	maculatum			
94R	TS01-1	Conium	maculatum			
94R	SG02-1	Cotoncaster	sp.	domestic		
94R	Blundell Is	Crataegus	monogyna	REC. - 940518		
93R	WE01-4	Crataegus	monogyna			
93R	Winter Cove	Crataegus	monogyna	RECONN.		
93R	DI01	Crepis	modocensis		Crepis	intermedia?
94R	GALI16-1	Crepis	modocensis		Crepis	intermedia?
94R	MA02-2	Crepis	modocensis		Crepis	intermedia?
94R	GALI18-1	Crepis				
93R	LPH04-1	Crepis				
93R	AHP01-4	Cryptantha	affinis	inclusion		
93R	CO01-3B	Cryptantha	affinis			
93R	NB03-1	Cryptogramma	crispa			
93R	SH01-1	Cryptogramma	crispa			
93R	GB02-17	Cynosurus	echinatus			
93R	MD01	Cynosurus	echinatus			
93R	MD05-OP	Cynosurus	echinatus			
93R	OH01-2	Cynosurus	echinatus			
93R	Woodsend Dr.	Cynosurus	echinatus	RECONN.		
93R	CO01-1	Cystopteris	fragilis			
93R	GB02-18	Cystopteris	fragilis			
93R	SA01-3	Cystopteris	fragilis			
93R	ES02-OP	Danthonia	californica			
93R	HE01	Danthonia	californica			
94R	PE01-2	Daucus	pusillus			
93R	SS14-1	Daucus	pusillus			
94R	BN02-2	Delphinium	menziesii			
94R	TH10-1	Delphinium	menziesii			
93R	UP05	Delphinium	menziesii			
93R	SS18	Dendroalsia	abietina	EP		
94R	TU02-1	Deschampsia	cespitosa			
93R	ES01	Dicranum	scoparium			
93R	GB02-22	Dicranum	scoparium			
94R	GLA03B-1	Dicranum	scoparium			
93R	JdF06-1	Dicranum	scoparium			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
94R	KH03B-2	Dicranum	scoparium			
94R	MA03-5	Dicranum	scoparium			
94R	MD06-2	Dicranum	scoparium			
93R	NB03-4	Dicranum	scoparium			
93R	PP01-5	Dicranum	scoparium	inclusion		
93R	PP01-8	Dicranum	scoparium			
93R	PP03-6	Dicranum	scoparium			
94R	RP07-1	Dicranum	scoparium			
93R	SA03-4	Dicranum	scoparium			
94R	TH02-1	Dicranum	scoparium			
93R	PP03-4	Dicranum	sp.	inclusion		
94R	Ft Rodd H.	Draba	verna	RECONN.		
94R	RP02-3	Elymus	mollis		Leymus	mollis
93R	GI01-2	Endymion	non-scripta		Hyacinoides	hispanicus?
93R	MH03-6	Epilobium	minutum			
93R	SA01-5	Epilobium	minutum			
93R	SA08-3	Epilobium	minutum			
94R	MW01-1	Epilobium	paniculatum		Epilobium	brachycarpum
94R	Blundell Is	Eriophyllum	lanatum	REC. - 940518		
93R	JdF03-	Erythronium	oregonum		Kindbergia	oregonum
93R	PP01-13	Erythronium	oregonum		Kindbergia	oregonum
93R	AHP01-2	Eurhynchium	oregonum		Kindbergia	oregonum
93R	ES05-1	Eurhynchium	oregonum		Kindbergia	oregonum
93R	JdF01	Eurhynchium	oregonum		Kindbergia	oregonum
93R	JdF05-3	Eurhynchium	oregonum		Kindbergia	oregonum
93R	PP03-5	Eurhynchium	oregonum	inclusion	Kindbergia	oregonum
94R	TH01-1	Eurhynchium	oregonum		Kindbergia	oregonum
93R	ES03-4	Evernia	mesomorpha			
93R	CO03	Festuca	bromoides		Vulpia	bromoides
94R	GLA01B	Festuca	bromoides		Vulpia	bromoides
93R	JdF03-5	Festuca	bromoides		Vulpia	bromoides
93R	MD01&2	Festuca	bromoides		Vulpia	bromoides
94R	MD01C-2	Festuca	bromoides		Vulpia	bromoides
93R	MH03-8	Festuca	bromoides		Vulpia	bromoides
94R	NA01-OP	Festuca	bromoides		Vulpia	bromoides
94R	OH01B-1	Festuca	bromoides		Vulpia	bromoides
94R	PE07-2	Festuca	bromoides		Vulpia	bromoides
93R	SX01	Festuca	bromoides		Vulpia	bromoides
93R	Woodsend Dr.	Festuca	bromoides	RECONN.	Vulpia	bromoides
94R	YE07-5	Festuca	bromoides		Vulpia	bromoides
94R	YE09-3	Festuca	bromoides		Vulpia	bromoides
94R	Blundell Is	Festuca	idahoensis	REC. - 940518		
93R	DI01	Festuca	idahoensis			
93R	GB03-	Festuca	idahoensis			
93R	HE01-OP	Festuca	idahoensis			
93R	HE02	Festuca	idahoensis			
94R	MA01-2	Festuca	idahoensis			
93R	NB01-2	Festuca	idahoensis			
94R	PE07-4	Festuca	idahoensis			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
93R	SA01-6	Festuca	idahoensis			
94R	FR01B-3	Festuca	megalura	var. hirsuta	Vulpia	myuros
94R	GALI04-2A	Festuca	megalura	var. hirsuta	Vulpia	myuros
94R	GALI04-2B	Festuca	megalura	var. hirsuta	Vulpia	myuros
94R	MD06-1	Festuca	megalura	var. hirsuta	Vulpia	myuros
94R	PE02-1	Festuca	megalura	var. hirsuta	Vulpia	myuros
93R	SA08-OP	Festuca	megalura	var. hirsuta	Vulpia	myuros
93R	SA08-2	Festuca	myuros	var. myuros	Vulpia	myuros
93R	CO03-OP	Festuca	occidentalis			
93R	GB03-2	Festuca	occidentalis			
93R	JdF04-3	Festuca	occidentalis			
93R	SS04-4	Festuca	occidentalis			
93R	NB02-4	Festuca	ovina			
93R	NH02-4	Festuca	rubra			
93R	UP04-1	Festuca	rubra			
93R	UP04-2	Festuca	rubra			
94R	YE08-1	Festuca	rubra			
94R	TH03-4	Fragaria	vesca			
94R	SU04-1	Fraxinus	latifolia	OP		
93R	GZ01B-1	Galium	aparine			
94R	PE01-1	Galium	aparine			
93R	SA04-3	Galium	aparine			
93R	SS18-1	Galium	aparine			
94R	TH03-2	Galium	aparine			
93R	GLA06-1	Geranium	carolinianum			
93R	CO04-1	Geranium	molle			
94R	PE01-7	Geranium	molle			
94R	YE07-2	Geranium	molle			
94R	Panama Hill	Gnaphalium	vulgare	RECONN		
93R	Bear Hill	Goodyera	oblongifolia	RECONN.		
94R	Blundell Is	Grindelia	integrifolia	REC. - 940518		
93R	SA08-6	Hieracium	albiflorum			
93R	SS18-PP/OH	Hieracium	albiflorum			
94R	OH07-1	Homalothecium	?			
93R	MF01-2	Homalothecium	aeneum			
93R	CO03-	Homalothecium	fulgescens			
93R	GB02-11	Homalothecium	fulgescens			
93R	GB02-12	Homalothecium	fulgescens			
93R	SX01-2	Homalothecium	fulgescens			
94R	FR01B-5	Homalothecium	megaptilum			
93R	PP03-7	Homalothecium	megaptilum			
93R	UP04-5	Hordeum	murinum			
93R	UP04B	Hordeum	murinum	930517		
94R	YE09-2	Hordeum	murinum			
93R	LP03-1	Hypochaeris	glabra			
93R	MH03-1	Hypochaeris	glabra			
93R	SA02-2	Hypochaeris	glabra			
94R	TH04-2	Hypochaeris	glabra			
94R	TH09-1	Hypochaeris	glabra			
*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).						

	PLOT /	GENUS	SPECIES	COMENTS	EQUIVALENT*	
	COLLECTION				GENUS	SPECIES
94R	OH05-2	Isoethecium ?				
94R	GALI04-3	Koeleria	macrantha			
94R	MA02-7	Koeleria	macrantha			
93R	NH02-3	Koeleria	macrantha			
94R	PE02-3	Koeleria	macrantha			
94R	RP06-1	Koeleria	macrantha			
94R	PE08-1	Lapsana	communis			
94R	CA02-2	Lathyrus	japonicus			
93R	BHP01-3	Lathyrus	nevadensis			
93R	JdF01	Lathyrus	nevadensis			
94R	SU02-3	Lathyrus	nevadensis			
94R	TH04-1	Lathyrus	nevadensis			
94R	Thetis Lk	Lathyrus	nevadensis	RECONN		
94R	YE08-2	Lathyrus	nevadensis			
94R	Tumbo Is.	Lepidium	virginicum	RECONN		
93R	Channel Rdge	Linanthus	bicolor	RECONN.		
94R	PE04-4	Linanthus	bicolor	OP		
94R	KH01B-3	Lithophragma	parviflora			
93R	BHP03-1	Lolium	perenne			
93R	BHP03-2	Lolium	persicum		Lolium	multiflorum
93R	TZ01-2	Lomatium	martindalei			
94R	Blundell Is	Lomatium	nudicaule	REC. - 940518		
93R	JdF04-2	Lomatium	nudicaule			
93R	NH03-1	Lomatium	triternatum			
94R	RP03-1	Lomatium	triternatum			
93R	KH01-1	Lomatium	utriculatum			
93R	MH03-11	Lomatium	utriculatum			
94R	Blundell Is	Lonicera	ciliosa	REC. - 940518		
93R	GB02-15	Lotus	micranthus			
94R	GLA02B-2	Lotus	micranthus			
94R	MA02-3	Lotus	micranthus			
93R	MH03-3	Lotus	micranthus			
93R	SA01-OP/OH	Lotus	micranthus			
93R	GLA01-1	Lupinus	micranthus		Lupinus	bicolor
93R	JdF03-1	Lupinus	micranthus		Lupinus	bicolor
94R	Mary Hill	Lupinus	micranthus	RECONN.	Lupinus	bicolor
93R	SA02-1	Lupinus	micranthus		Lupinus	bicolor
93R	SH01-3	Lupinus	micranthus		Lupinus	bicolor
93R	TZ01-1	Lupinus	micranthus		Lupinus	bicolor
93R	SA07-OP/OH	Lupinus	micranthus		Lupinus	bicolor
94R	PE03-4	Luzula	multiflora			
93R	PP01-3	Luzula	multiflora			
94R	GALI17-1	Lychnis	coronaria			
93R	SS06	Lychnis	coronaria			
93R	ES02-OP	Madia	glomerata			
93R	SS06-OP	Madia	glomerata			
93R	DI01-4	Madia	sativa			
94R	MA02-2	Madia	sativa			
94R	Montague Hb	Madia	sativa	RECONN.		

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT /	GENUS	SPECIES	COMENTS	EQUIVALENT*	
	COLLECTION				GENUS	SPECIES
93R	NB04-2	Madia	sativa			
93R	SS04-3	Madia	sativa			
93R	SS17-1	Madia	sativa			
93R	SX01-7	Madia	sativa			
93R	TZ01-1	Madia	sativa			
93R	CO01	Melica	subulata			
93R	DI01	Melica	subulata			
93R	SA08-1	Microseris	bigelovii			
93R	SA01-1	Mimulus	guttatus	OP		
94R	Cairn Pk.	Montia	dichotoma	RECONN.		
93R	SA04-4	Montia	linearis			
94R	BN05-2	Montia	parvifolia			
94R	GLA05B-1	Montia	parvifolia			
93R	PP01-10	Montia	parvifolia			
94R	FR01B-1	Montia	perfoliata		Claytonia	perfoliata
93R	GB02-6	Montia	perfoliata		Claytonia	perfoliata
93R	GZ01B	Montia	perfoliata		Claytonia	perfoliata
94R	KH03B-1	Montia	perfoliata		Claytonia	perfoliata
93R	NH03-2	Montia	perfoliata		Claytonia	perfoliata
94R	TH02-3	Montia	perfoliata		Claytonia	perfoliata
93R	CO01-1	Montia	perfoliata		Claytonia	perfoliata
94R	GALI13-1	Muhlenbergia	filiiformis			
93R	CO01-2	Myosotis	discolor			
93R	DI01	Myosotis	discolor			
93R	GB02-10	Myosotis	discolor			
93R	MH03-4	Myosotis	discolor			
94R	PE03-2	Myosotis	discolor			
93R	SA04-7	Myosotis	discolor			
94R	TH10-3	Myosotis	discolor			
94R	YE07-3	Myosotis	discolor			
94R	Panama Hill	Navarretia	squarosa	RECONN		
94R	PE01-8	Nemophila	parviflora			
94R	TH09-2	Nemophila	parviflora			
93R	GB03-1	Nemophila	parvifolia			
94R	UV01-2	Oenleria	verasiformis			
93R	NH01-1	Orobanche	uniflora			
93R	SA01-OP/OH	Orthocarpus	attenuatus			
94R	GALI01-4	Orthocarpus	pusillus			
93R	UP04-13	Orthocarpus	pusillus			
93R	PP03-3	Osmorhiza	chilensis			
93R	HE03	Panicum	scribnerianum			
93R	Wallace Pt.	Panicum	scribnerianum	RECONN.		
94R	MA02-5	Parmelia	sulcata			
94R	PI01-3	Parmelia	sulcata			
93R	SX01	Parmelia	sulcata			
93R	PP02-1	Peltigera	leucophlebia			
93R	PP01-4	Peltigera	neopolydactyla			
94R	GALI14-1	Perideridia	gairdneri			
93R	GB02-17	Pityrogramma	triangularis		Pentogramma	triangularis
*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).						

	PLOT /	GENUS	SPECIES	COMENTS	EQUIVALENT*	
	COLLECTION				GENUS	SPECIES
93R	NB04-1	Pityrogramma	triangularis		Pentogramma	triangularis
93R	SA01-2	Pityrogramma	triangularis		Pentogramma	triangularis
94R	PE07-3	Plantago	lanceolata			
94R	Blundell Is	Plectritus	congesta	REC. - 940518		
94R	Glendale Lnds.	Plectritus	congesta	REC. - photo site		
93R	PP01-14	Plectritus	congesta			
94R	Glendale Lnds.	Plectritus	macrocera	REC. - photo site		
93R	MD06-3	Pleurozium	schreberi			
93R	AHP01-3	Poa	annua			
94R	YE02-1	Poa	annua			
93R	UP04-7	Poa	bulbosa			
94R	BN05-1	Poa	compressa			
93R	UP04-6	Poa	compressa			
93R	JdF01-	Poa	pratensis			
94R	JP03-1	Poa	pratensis			
94R	JP04-1	Poa	pratensis			
94R	PE01-6	Poa	pratensis			
94R	SU02-1	Poa	pratensis			
94R	SU02-2	Poa	pratensis			
94R	YE07-7	Poa	pratensis			
94R	YE07-8	Poa	pratensis			
94R	George Hill	Poa	sandbergii	RECONN.	Poa	secunda
93R	SG01-3	Poa	sandbergii		Poa	secunda
93R	SS15-1	Poa	sandbergii		Poa	secunda
93R	GB03-3	Poa	scabrella			
94R	Obscv. H.	Poa		RECONN		
93R	TZ01-5	Polygonum	spergulariaeforme			
93R	PP02-4	Polypodium	glycyrrhiza			
93R	NH01-3	Polystichum	munitis	var. imbricans	Polystichum	imbricans
94R	LTH01-1	Polystichum				
94R	GLA03B-2	Polytrichum	juniperinum			
93R	PP02-3	Polytrichum	juniperinum			
94R	KH01B	Polytrichum	piliferum			
93R	SA08-5	Polytrichum	piliferum	inclusion		
93R	UP04-8	Polytrichum	piliferum			
94R	Blundell Is	Populus	tremuloides	REC. - 940518		
93R	MF02-1	Potentilla	glandulosa			
94R	PA01-1	Prunus	domestica			
94R	CA02-1	Prunus	virginiana			
93R	SA06-1	Prunus	virginiana			
93R	PP03-4	Pseudotaxiphyllum	elegans			
93R	PP03-5	Pseudotaxiphyllum	elegans			
93R	High Salal	Quercus	garryana	RECONN.		
93R	SA01	Quercus	garryana	OP		
93R	WE01-2	Quercus	garryana			
94R	GLA03B-3	Rhacomitrium	canescens		Rhacomitrium	canescens
93R	PP01-2	Rhacomitrium	canescens		Rhacomitrium	canescens
93R	PP03-3	Rhacomitrium	canescens		Rhacomitrium	canescens
93R	SKM01-1	Rhacomitrium	canescens		Rhacomitrium	canescens

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
93R	TZ01-4	Rhacomitrium	canescens		Racomitrium	canescens
93R	UP04-9	Rhacomitrium	canescens		Racomitrium	canescens
94R	BN08-1	Rhacomitrium	heterostichum	?	Racomitrium	heterostichum
93R	SKM01-2	Rhacomitrium	sp.		Racomitrium	sp.
94R	BN02-1	Rhinanthus	crista-galli		Rhinanthus	minor
93R	MD03	Rorippa	islandica	var. islandica		
93R	CO01-2	Rosa	eglanteria			
94R	GAL103-3	Rosa	gymnocarpa			
94R	HA01-1	Rosa	gymnocarpa			
93R	High Salal	Rosa	gymnocarpa	RECONN.		
93R	JdF01-1	Rosa	gymnocarpa			
94R	MD06-4	Rosa	gymnocarpa			
93R	NB04-3	Rosa	gymnocarpa			
93R	SX02-1	Rosa	gymnocarpa			
94R	TH06-2	Rosa	gymnocarpa			
94R	FR02B-5	Rosa	nutkana			
94R	GAL103-2	Rosa	nutkana			
94R	GLA01B	Rosa	nutkana			
94R	UV01-1	Rosa	nutkana			
93R	JdF05-2	Rosa	pisocarpa			
93R	UP09-1	Rubus	leucodermis			
94R	FR04B-1	Rubus	ursinus			
94R	Blundell Is.	Salix	hookeriana	REC. - 940518		
93R	DI01	Sanicula	crassicaulis			
94R	FR01B-4	Schistidium	sp. ?			
94R	Songhees	Sedum	sp. (domestic)	RECONN		
94R	YE01-1	Sedum	sp. (domestic)			
94R	Blundell Is	Sedum	spathulifolium	REC. - 940518		
94R	MA02-6	Selaginella	wallacei			
93R	NB04	Selaginella	wallacei			
93R	PP02-2	Selaginella	wallacei			
93R	Bear Hill	Senecio	vulgaris	RECONN.		
94R	BN01-3	Sherardia	arvensis			
93R	GB02-19	Sherardia	arvensis			
93R	GLA01-2	Sherardia	arvensis			
94R	PE04-3	Sherardia	arvensis			
93R	SA02-4	Sherardia	arvensis			
93R	SS18-3	Sherardia	arvensis			
93R	TZ01-3	Sherardia	arvensis			
93R	Gonzales H.	Sisyrinchium	douglasii	RECONN.	Olsynium	douglasii
93R	GB02-8	Sonchus	asper			
94R	TH03-3	Stellaria	media			
94R	TH10-2	Stellaria	media			
93R	GB02-3	Stellaria	nitens			
93R	SA04-5	Stellaria	nitens			
93R	CO04-OP	Stipa	lemmonii			
94R	MA03-2	Stipa	lemmonii			
93R	NB04	Stipa	lemmonii			
94R	PE02-4	Stipa	lemmonii			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
93R	SA01-1	Stipa	lemmonii			
93R	SS09	Stipa	lemmonii			
93R	TZ01-6	Stipa	lemmonii			
94R	GALI02-1	Symphoricarpos	albus			
94R	Woodley Rng.	Symphoricarpos	mollis	RECONN		
94R	FR02B-4	Teesdalia	nudicaulis			
94R	KH02B-1	Teesdalia	nudicaulis			
93R	LP01-1	Teesdalia	nudicaulis			
93R	Woodsend Dr.	Teesdalia	nudicaulis	RECONN.		
94R	GALI04-1	Tortula	ruralis			
93R	GB02-9	Tortula	ruralis			
93R	BHP03-1	Trifolium	depauperatum			
93R	Helliwell	Trifolium	depauperatum	RECONN.		
93R	UP05-1	Trifolium	depauperatum			
93R	AHP01-6	Trifolium	dubium			
93R	BHP03-1	Trifolium	dubium	inclusion		
93R	BHP03-3	Trifolium	dubium			
94R	Ft Rodd H.	Trifolium	dubium	RECONN.		
93R	JdF03-7	Trifolium	dubium			
93R	NB04-5	Trifolium	dubium			
94R	PE04-1	Trifolium	dubium			
93R	PP01-6	Trifolium	dubium			
93R	SA01-OP/OH	Trifolium	dubium			
93R	SS12-OP	Trifolium	dubium			
94R	GLA02B-1	Trifolium	microcephalum			
94R	MA03-3	Trifolium	microcephalum			
93R	MD03	Trifolium	microcephalum			
94R	PE03-3	Trifolium	microcephalum			
93R	SA01-4	Trifolium	microcephalum			
93R	SA03	Trifolium	microcephalum	OP/OH		
93R	SA03-1	Trifolium	microcephalum			
93R	SA04-6	Trifolium	microcephalum			
93R	SS10	Trifolium	microcephalum			
93R	GB02-2	Trifolium	oliganthum			
93R	HE01-OP	Trifolium	oliganthum			
93R	NH02-1	Trifolium	oliganthum			
94R	PE05-1	Trifolium	oliganthum			
93R	SA01-OP/OH	Trifolium	oliganthum			
93R	SA03-2	Trifolium	oliganthum			
93R	SS10	Trifolium	oliganthum			
93R	DI01	Trifolium	repens			
93R	ES03-2	Trifolium	tridentatum			
93R	Gonzales H.	Trifolium	tridentatum	RECONN.		
93R	NB02-2	Trifolium	tridentatum			
93R	SA03-3	Trifolium	tridentatum			
93R	SA08-4	Trifolium	tridentatum			
93R	SH01-2	Trifolium	tridentatum			
93R	SS19	Trifolium	tridentatum			
93R	GB02-1	Trifolium	variegatum			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
93R	SS05-1	Trifolium	variegatum			
93R	Goldstream Pk	Trifolium	wormskjoldii	RECONN.		
93R	CO01-3	Trifolium				
93R	NB02-1	Trifolium				
93R	NH01-4	Trifolium				
93R	Harewood Plns	Trisetum	canescens	RECONN.		
93R	SS02	Triteleia	hyacinthina			
93R	SS18	Triteleia	hyacinthina			
93R	SS18-OP/OH	Triteleia	hyacinthina			
93R	Thimble Farms	Triteleia	hyacinthina	RECONN.		
93R	Uplands Pk	Triteleia	hyacinthina	RECONN.		
94R	BN01-2	uk. herb				
94R	MA02-4	uk. lichen				
94R	PI01-4	uk. lichen				
93R	GLA02-1	uk. moss				
93R	GZ01B	uk. moss				
93R	MF01-3	uk. moss				
93R	SH02-1	uk. moss				
94R	TH04-3	uk. moss				
93R	DI01	uk. shrub		("G.ovatifolia")		
93R	PP01-11	Veronica	arvensis			
93R	GB02-4	Veronica	serpyllifolia			
93R	SA04-2	Veronica	serpyllifolia			
93R	SS05-2	Veronica	serpyllifolia			
94R	YE07-4	Veronica	serpyllifolia			
94R	BN01-1	Vicia	americana			
94R	GAL103-1	Vicia	americana			
93R	GB02-6	Vicia	americana			
93R	GI05	Vicia	americana			
94R	MA02-1	Vicia	americana			
93R	NB01-3	Vicia	americana			
94R	PE01-8	Vicia	americana			
94R	PE02-5	Vicia	americana			
94R	RP01-2	Vicia	americana			
93R	SS01-1	Vicia	americana			
93R	UP05B-4	Vicia	cracca			
93R	GLA01-3	Vicia	hirsuta			
93R	JdF01	Vicia	hirsuta			
93R	NH01-2	Vicia	hirsuta			
94R	PE07-OP	Vicia	hirsuta			
93R	PP01-7	Vicia	hirsuta			
93R	UP05-3	Vicia	hirsuta			
94R	YE07-9	Vicia	hirsuta			
93R	BHP01-4	Vicia	sativa			
93R	BHP03-1A	Vicia	sativa	inclusion		
93R	CO03-1	Vicia	sativa			
93R	CO04-2	Vicia	sativa			
93R	CO04-3	Vicia	sativa			
93R	ES03-3	Vicia	sativa			

*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).

	PLOT / COLLECTION	GENUS	SPECIES	COMENTS	EQUIVALENT*	
					GENUS	SPECIES
93R	Harewood Plns	Vicia	sativa	RECONN.		
93R	JdF01	Vicia	sativa			
94R	MD01C-3	Vicia	sativa			
93R	NH02-5	Vicia	sativa			
94R	PE01-9	Vicia	sativa			
93R	SP01-2	Vicia	sativa			
93R	NH02-1	Viola	praemorsa			
94R	Blundell Is.	Xanthoparmelia	cumberlandia	REC. - 940518		
93R	UP05B	Zygadenus	venosus			
*These are taxonomic equivalents from Douglas et al (1989 etc.) and Schofield (1992).						
SPECIES FROM COLLECTIONS NOT IN THE DATA TABLES						
		Agoseris	glauca	1 plot		
		Alchemilla	occidentalis	8 plots		
		Bromus	pacificus	1 plot		
		Caucalis	microcarpa	3 plots		
		Cladonia	portentosa	5 plots		
		Collomia	heterophylla	1 plot		
		Cryptantha	affinis	2 plots		
		Dendroaesia	abietina	1 plot		
		Evernia	mesomorpha	1 plot		
		Festuca	megalura	6 plots		
		Fraxinus	latifolia	1 plot		
		Homalothecium	aeneum	1 plot		
		Homalothecium	fulgescens	3 plots		
		Homalothecium	megaptitum	2 plots		
		Lomatium	martindalei	1 plot		
		Madia	glomerata	2 plots		
		Microseris	biglovii	1 plot		
		Muhlenbergia	filiformis	1 plot		
		Orthocarpus	attenuatus	1 plot		
		Parmelia	sulcata	3 plots		
		Peltigera	leucophlebia	1 plot		
		Peltigera	neopolydactyla	1 plot		
		Poa	compressa	2 plots		
		Poa	scabrella	1 plot		
		Prunus	domestica	1 plot		
		Pseudotaxiphyllum	elegans	2 plots		
		Rorippa	islandica	1 plot		
		Rosa	eglanteria	1 plot		
		Schistidium	sp. ?	1 plot		
		Sonchus	asper	1 plot		
		Veronica	arvensis	1 plot		
CHANGES TO THE PLANT COMMUNITIES:						
One plot (93R NB01) is added to c42.						
One plot (94R MA02-1) is deleted from c49.						

OTHER TAXONOMIC EQUIVALENTS					
TIHS STUDY			DOUGLAS et al.		
GENUS		SPECIES	GENUS		SPECIES
	Agrostis	alba	Agrostis	gigantea	
	Fritillaria	lanceolata	Fritillaria	affinis	
	Juncus	arcticus	Juncus	balticus	
	Lychnis	alba	Silene	alba	
	Paxistima	myrsinites	Pachystima	myrsinites	
	Platanthera	unalescensis	Piperia		
	Platanthera	unalescensis	Piperia	elegans	
	Zigadenus	venosus	Zygadenus	venosus	

APPENDIX 12 BENCHMARK COMPARISONS WITH THE ADJUSTED MOTYKA COEFFICIENT

Two comparisons were selected to provide benchmarks for viewing the method and the level of distinction used in my classification. The first used a value of 1.0, representing approximately equal similarities and differences, the second used the average value (0.57) obtained from the comparisons.

EQUAL SIMILARITIES AND DIFFERENCES

An Adjusted Motyka value of 1.0 was obtained for a comparison of the **Oak - Bromus sterilis c23** and the **Oak - Poa pratensis c29a** plant communities, so this was selected as a benchmark that should relate an approximately equal degree of similarities and differences. The following describes the differences and similarities (see Ecosystem Descriptions (5.11) for cover classes):

In **c29a**, *Poa pratensis* (introduced Kentucky bluegrass) is on all sites and averages cover class 3 or 4, whereas in **c23** it is present at less than the requirement of 0.70.

Bromus sterilis (introduced barren barngrass) is present on all sites, with an average class 4 cover in **c23**. The species is present on most sites in **c29a** and averages class 2 cover.

Vicia sativa (introduced common vetch) is present on all sites in **c23** and averages class 2 to 3 cover. *Vicia sativa* is also present on most sites in **c29a** and averages cover class 3, but is present on less than 0.70 of sites in **c23**.

Geranium molle (introduced dovefoot geranium) and *Vicia hirsuta* (introduced hairy vetch) are present on most sites in **c29a** and average class 2 to 3. *Geranium molle* is present on less than 0.70 of sites in **c23**. *Vicia hirsuta* is present on most sites in **c23** and averages class 2 cover.

Elymus glaucus (blue wildrye), *Sanicula crassicaulis* (Pacific snakeroot) and *Galium aparine* (cleavers) are present on most sites in **c29a** and **c23**, averaging cover class 2. *Bromus carinatus* (California brome) is present on most sites in both **c23** and **c29a**, averaging class 2 cover in **c23** and class 1 to 2 cover in **c29a**.

Festuca bromoides (introduced annual fescue) is present on most sites in both c23 and c29a, averaging class 2 and 1 cover, respectively.

Hypochaeris radicata (introduced hairy cats ear) is present on most sites in c29a and averages class 1 cover. The species is present on less than 0.70 of the sites of c23.

AVERAGE COMPARISON

However, the mean value of 0.57 from the adjusted Motyka comparisons suggest that the average degree of differences and similarities can be represented by the comparison of c47 Oak- *Elymus glaucus* and c14 Oak - *Carex inops*, the middle of three comparisons with this value.

Elymus glaucus (blue wildrye) is present in c47 on all sites and averages cover class 3 to 4. *Elymus glaucus* is present on most sites in c14 and averages class 2 cover.

Carex inops (long-stolonned sedge) is present on all sites in c14 and averages a cover of class 4. *Carex inops* is present on most sites in c47 averages cover class 2 to 3.

Vicia sativa (introduced common vetch) is present on all sites in c14 and averages a cover of class 1 to 2. The species is present on less than 0.70 of sites in c47.

Galium aparine (cleavers) is present on most sites in both c14 and c47 and averages class 2 cover.

Sanicula crassicaulis (Pacific snakeroot) is present on most sites in c47 and averages cover class 2. It is present on less than 0.70 of sites in c14.

Ranunculus occidentalis (western buttercup) and *Vicia hirsuta* (introduced hairy vetch) are present on most sites in c14 and average class 2 cover. *Danthonia californica* (California oatgrass) and *Rumex acetosella* (introduced sheep sorrel) on most sites in c14 and average class 1 cover. All these last four species are present at less than 0.70 cover in c47.

APPENDIX 13 COMPARISONS OF PLANT COMMUNITIES FROM OTHER SOURCES

A series of comparisons were completed using data from other relevant studies from the Pacific Northwest, in order to provide a further perspective for my classification. Coefficient values are shown as follows, in **bold**:

2.98 *Pinu* (PON) - *Agropyron* - *Lupinus* - *Rosa (woo)* subassociation with *Pinu* (PON) - *Agropyron* - *Lupinus: Koeleria* subassoc. (PPdh2 01 NELSON REG. with PPdh1 01 NELSON REG., BC MOF)

2.44 *Pinu* (PON) - *Agropyron* - *Festuca* association with *Pinu* (PON) - *Agropyron; Opuntia* subassoc. (PPxh1 01 KAMLOOPS REG. with PPxh2 03 KAMLOOPS REG., BC MOF)

0.87 *Q/Fest ovi* CT with *Q/Cyno ech* CT (Riegel et al. ORE)

0.67 *Q/Brom car* CT with *Q/Cyno ech* CT (Riegel et al. ORE)

0.54 *Pinu* (PON) - *Aristida* assoc., *Purshia* subassoc. with *Pinu* (PON) - *Rhus* - subassoc.) BGxh1 04 KAM with BGxh1 05 KAM

0.44 *Q/Dactylis* v. *Q/Delphinium* (Sugihara et al. CA)

0.43 *Pinu* (PON) - *Agropyron* - *Festuca (ida)* subassoc. with *Pinu* (PON) - *Agropyron* - *Festuca (sca)* subassoc. (PPxh1 01 KAM v. BGxw1 05 KAM BC MOF)

0.38 *Q/Fest ovi* v. *Q/Elym glau* (Riegel et al. ORE)

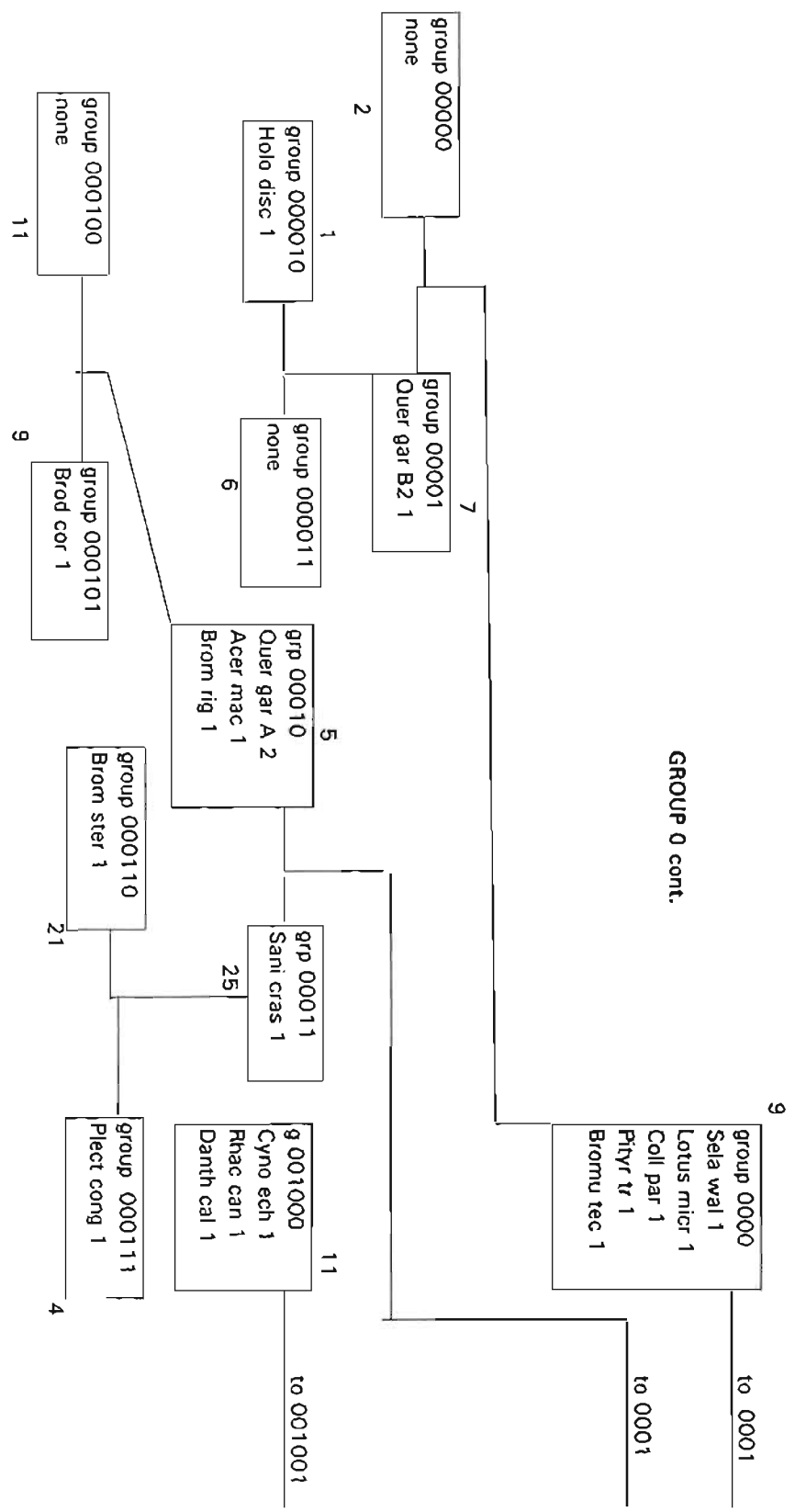
0.32 *Q/Symph* v. *Q/Dactylis* (Sugihara et al. CA)

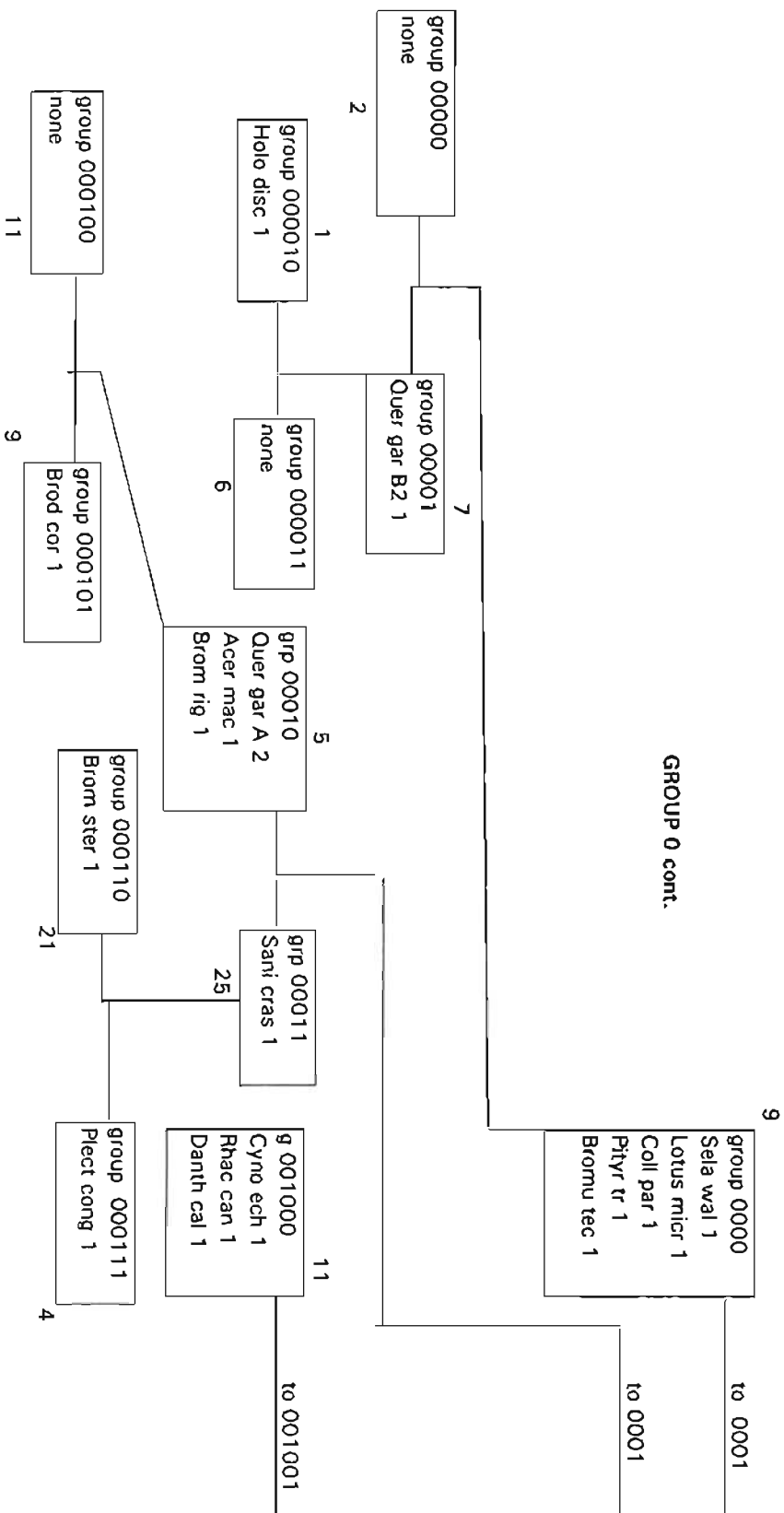
0.31 *Q/Philad/Cystopt* v. *Q/Ribes/Phacelia* (Sugihara et al. CA)

0.31 *Q/Dactylis* v. *Q/Cynosurus* (Sugihara et al. CA)

The foregoing BC MOF comparisons were for units distinguished by their vegetation classification within the biogeoclimatic classification. Two comparisons were also completed for units distinguished by the BC MOF biogeoclimatic classification, but not by the vegetation classification. The result was very high similarity values: **22.1** for IDFxh1 "91" (KAM) v. IDFdk1 "91" (KAM); and **5.97** for IDFxh1 "91" (KAM) v. BBxw1-06 (KAM).

Sources: 1) summary tables from the biogeoclimatic ecosystem classification of the B.C. Ministry of Forests; 2) Riegel et al., 1992, for southwest Oregon; and 3) Sugihara et al., 1987, Bald Hills oak woodlands of Redwood National Park, CA.





APPENDIX 15 CLIMATE IN THE STUDY YEARS

The objective was to assess the potential for variations in weather over the four years to have influenced study vegetation. A comparison was made of the climate for the four years, 1991 to 1994, in relation to each other and two sets of normals (1951-1980 and 1961-1990) (Figures 29 to 33).

The year 1991 preceding the study had high and above normal precipitation for April and August and low and below normal for June and September. The year 1991 was the coolest of the four in mean monthly temperatures and near-normal, except for June which was below normal. Sunshine hours were the highest and above normal for April, lowest and below normal for May, June, July, August.

Winter precipitation from Oct/91 to Feb/92 was slightly above normal, probably resulting in adequate or surplus soil moisture recharge for 1992 spring growth. Low and below normal precipitation followed for March, May, August and September. The year 1992 was warm and well above normal in the spring months. Sunshine hours were highest and above normal for March, May, June, and August.

Winter precipitation from Oct/92 to Feb/93 was only about 2/3 of normal, so there may not have been adequate or surplus soil moisture recharge for 1993 spring growth. This was followed by high and above normal precipitation for March, May and July, and low/below normal for August and September. It was warm and well above normal in the spring months. Sunshine hours were lowest and below normal for April and July, and highest, above normal for September.

Winter precipitation from Oct/93 to Feb/94 was only about 2/3 of normal, so there may not have been adequate or surplus soil moisture recharge for 1994 spring growth. Precipitation was high/above normal for March and low/below normal for July. The year was warm and well above normal for all months except June. Sunshine hours were highest and above normal for July.

Figure 29. Victoria Airport Mean Winter Monthly Precipitation

525

mm. of precipitation (file = weath3a.ch3)

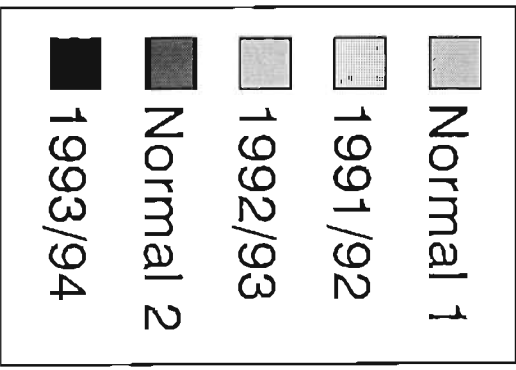
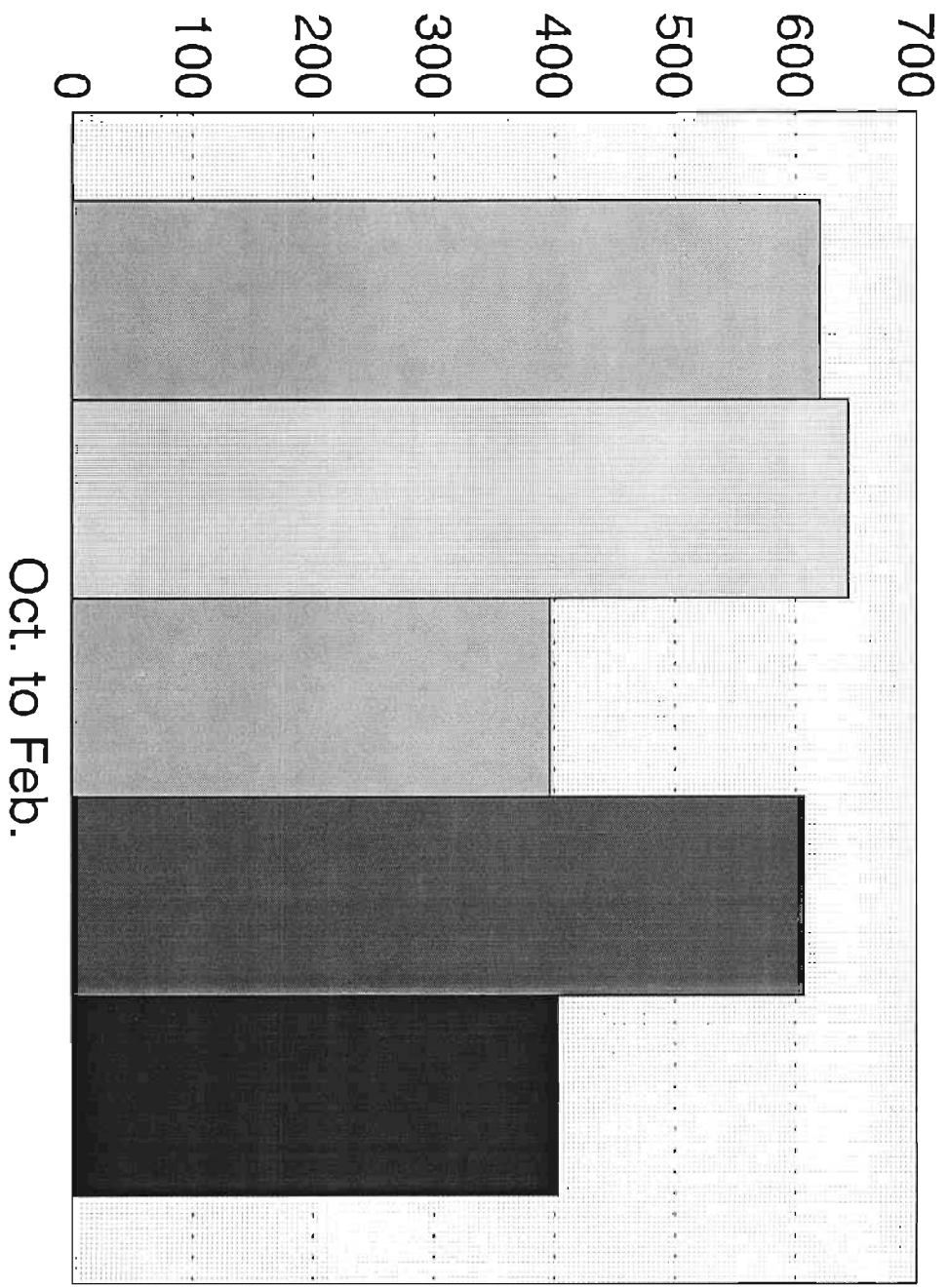
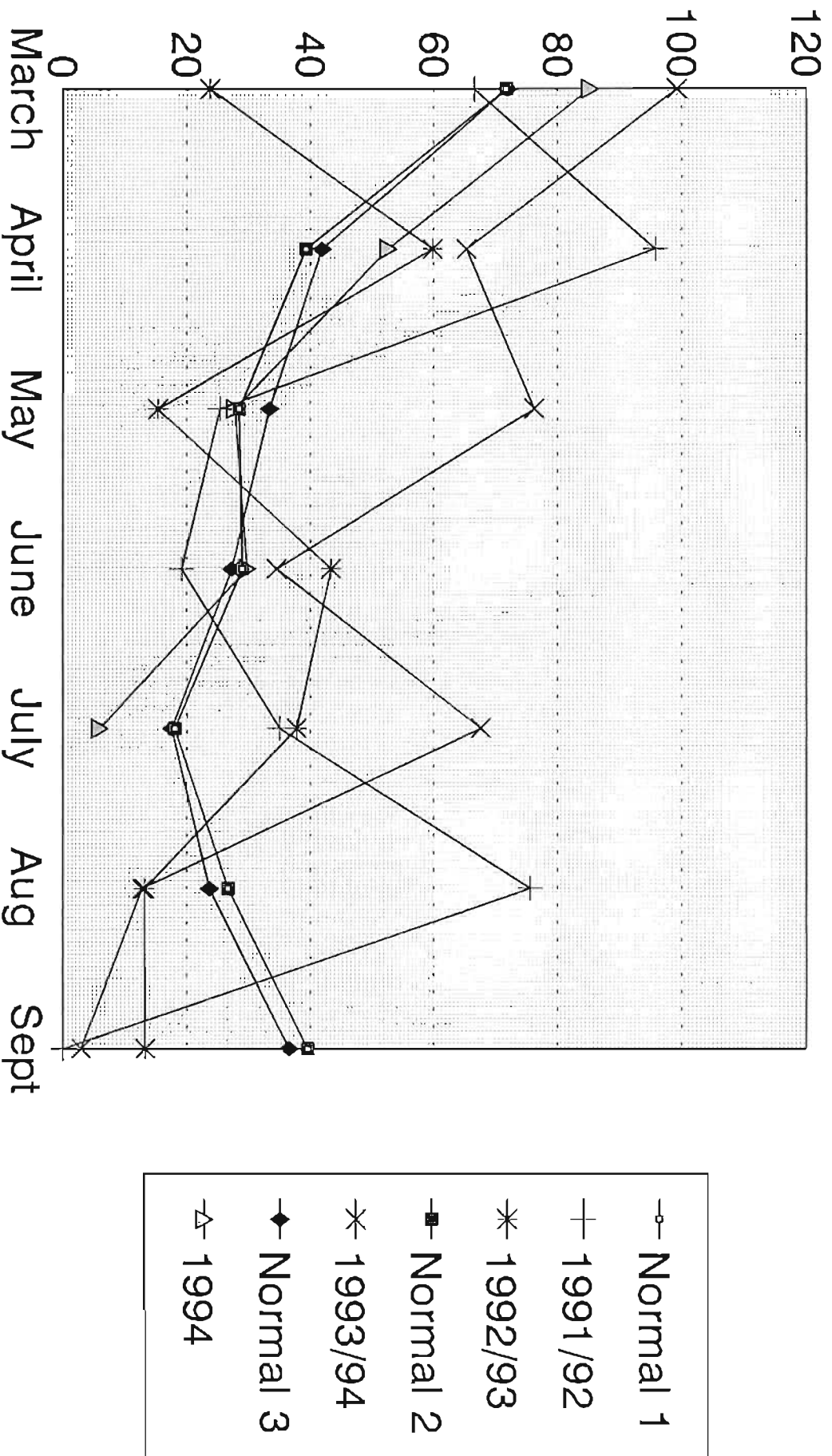


Figure 30. Victoria Airport Mean Monthly March to September Precipitation
mm of precipitation (file=weath3.ch1)

526



527 **Figure 31. Victoria Airport Mean Temperature**
degree C. (file=weath1.ch1)

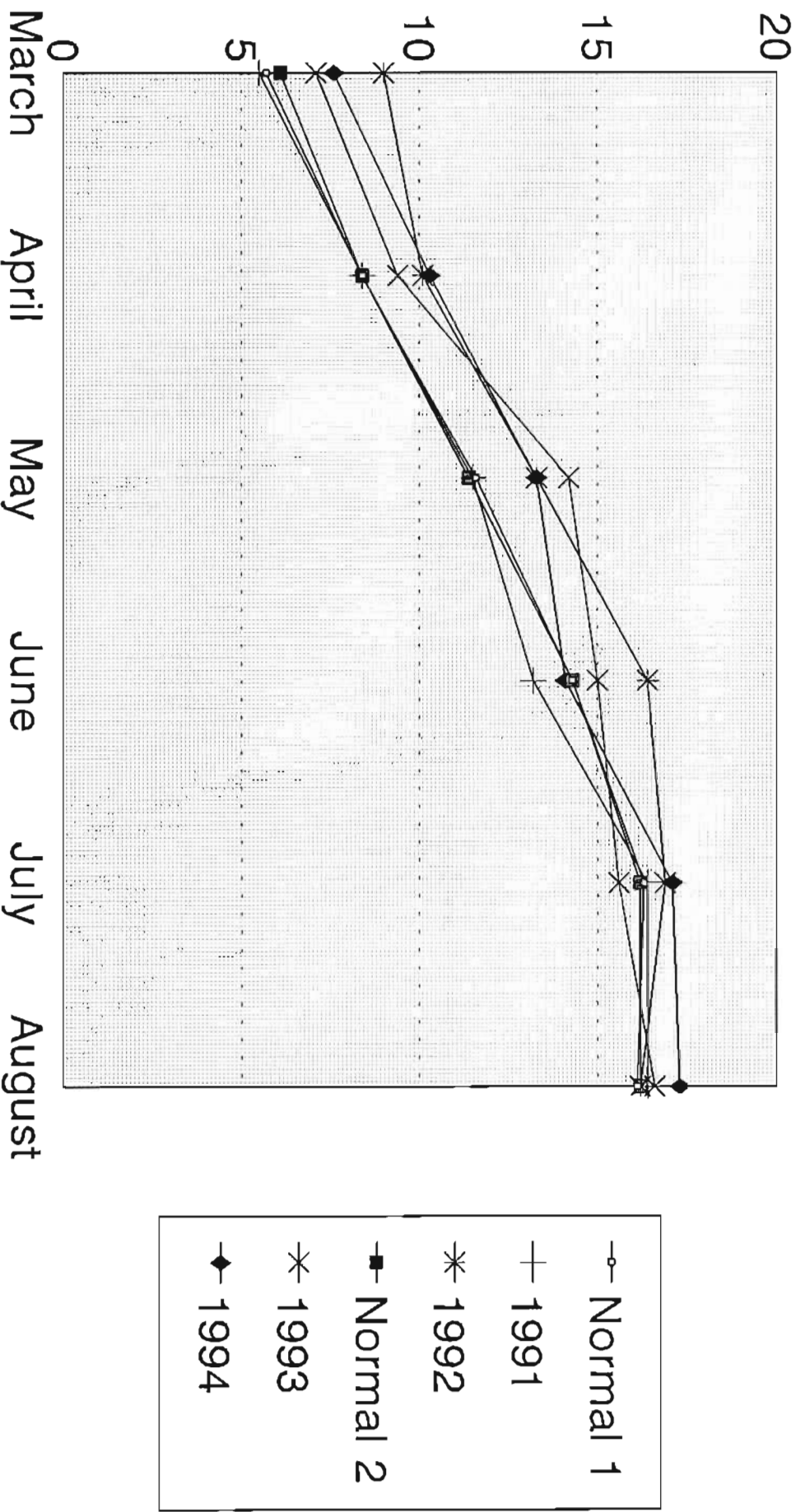


Figure 32. Victoria Airport Mean Monthly Sunshine Hours
hours of sunshine (file=weath4.ch1)

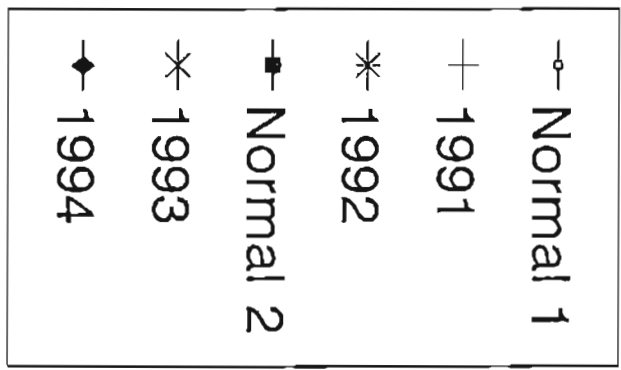
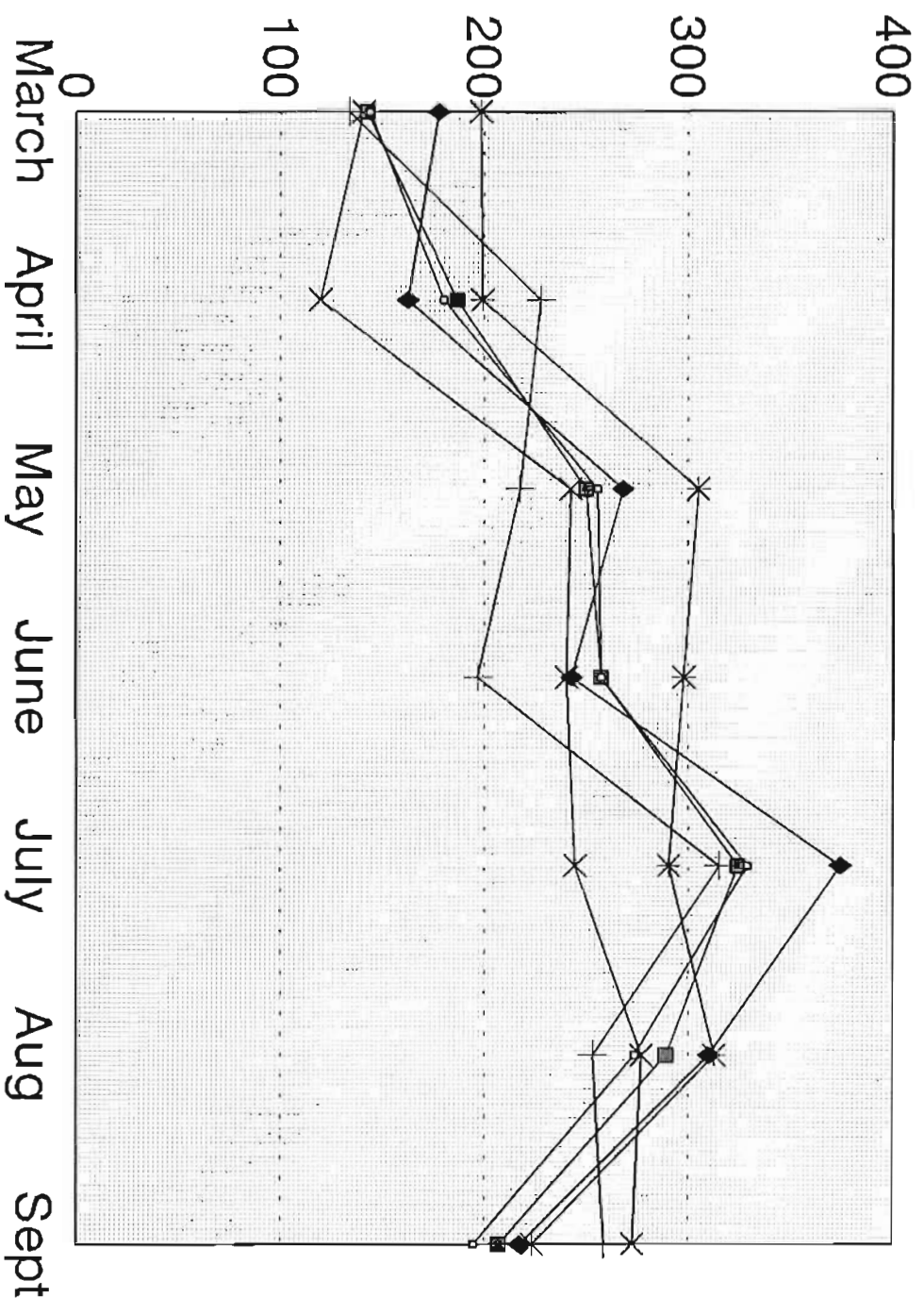
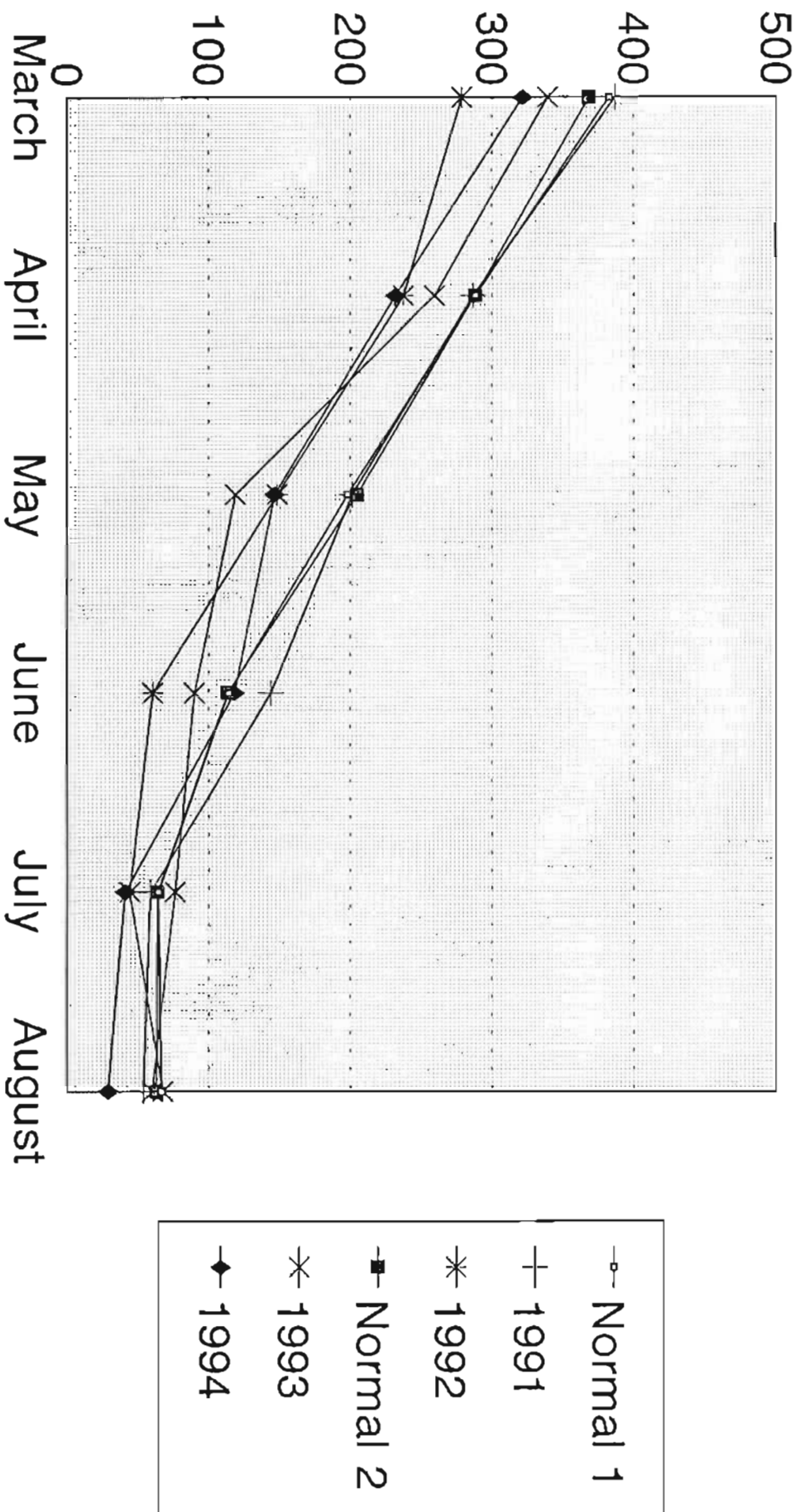


Figure 33. Victoria Airport Degree Days Below 18 deg.C.

529

degree days below 18 deg. C. (file=weath2.ch3)



The climate of the preceding year to the study, 1991, was close to normal, although a little cooler and cloudier. The year 1993 was also near normal, but had much lighter winter precipitation for spring growth, probably offset by high and above normal precipitation in three months. This year had warmer spring temperatures than normal. The year 1992 had adequate or surplus winter precipitation for spring growth, but then had low precipitation for four of the remaining months and temperatures above normal for the spring months. The year 1994 had light winter precipitation for spring growth with mixed precipitation patterns. Temperatures were above normal for most months.

While the year-by-year climate does not fall within normals for all years, variations fall both above and below the norm for most categories, suggesting averages similar to normal. It seems unlikely these variations were enough to make a difference in vegetation away from that of normal years or cycles. Many of the dominant plants of the communities are perennials, which should be resistant to adverse variations. The shortfall in winter precipitation may have affected only surplus soil moisture, not storage/recharge. The March to September precipitation pattern was probably not far off normal, with slightly more months (3) with generally higher precipitation over the four years. Monthly mean temperatures were generally higher than the normals. Sunshine hours were generally equal to normal across the four years. 'Degree Days below 18 deg. C.' followed the mean temperature trend, so was not interpreted separately.